SYLLABUS FOR COMPUTER SCIENCE & ENGINEERING
B.TECH (AUTONOMOUS)
DURATION: 4 YEARS (EIGHT SEMESTERS)

SYLLABUS

FOR

FOUR-YEAR B. TECH PROGRAMME

IN

COMPUTER SCIENCE & ENGINEERING

NAAC – A Grade

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous and Constituent College of BPUT, Odisha) Techno Campus, MahalaxmiVihar, Ghatikia,

Bhubaneswar-751029, Odisha, INDIA

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1st SEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Basic Science Course	UBSPH101	Physics	3	1	0	4	30	70	0	100
2	Basic Science Course	UBSMH102	Mathematics-I	3	1	0	4	30	70	0	100
3	Engineering Science Course	UESEE103	Basic Electrical Engineering	3	1	0	4	30	70	0	100
4	Basic Science Course	ULCPH101	Physics Lab	0	0	3	1.5	0	0	100	100
5	Engineering Science Course	ULCEE102	Basic Electrical Engineering Lab	0	0	2	1	0	0	100	100
6	Engineering Science Course	ULCME105	Workshop\Basic Manufacturing Practices Lab	1	0	4	3	0	0	100	100
7	Humanities &Social Sciences	UHSMH105	English	2	0	0	2	30	70	0	100
8	Humanities &Social Sciences	ULCMH104	English Lab	0	0	2	1	0	0	100	100
7	Mandatory Course	**Induction Program (21 Days)**									
			Total				**20.5**				**800**

2nd SEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Basic Science Course	UBSCH201	Chemistry	3	1	0	4	30	70	0	100
2	Basic Science Course	UBSMH202	Mathematics-II	3	1	0	4	30	70	0	100
3	Engineering Science Course	UESCS203	Programmingfor ProblemSolving	3	0	0	3	30	70	0	100
4	Basic Science Course	ULCCH201	Chemistry Lab	0	0	3	1.5	0	0	100	100
5	Engineering Science Course	ULCCS202	Programming for Problem Solving Lab	0	0	4	2	0	0	100	100
6	Engineering Science Course	ULCME203	Engineering Graphics and DesignLab	1	0	4	3	0	0	100	100
7	Engineering Science Course	UESIE202	BASIC ELECTRONICS ENGINEERING	2	0	0	2	30	70	0	100

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8	LAB Course	ULCIE202	BASIC ELECTRONICS ENGINEERING LAB	0	0	2	1	0	0	100	100
			Total				**20.5**				**800**
9	**Summer Internship programme (4 to 8 weeks) is mandatory as per AICTE rule**										

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3rdSEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Core Course	UPCCS301	Data Structures	3	0	0	3	30	70	0	100
2	Core Course	UPCCS302	Object Oriented Programming	3	0	0	3	30	70	0	100
3	Core Course	UPCCS303	Discrete Structures	3	1	0	4	30	70	0	100
4	Engg. Science Course	UESIE311	Digital System Design	3	0	0	3	30	70	0	100
5	Basic Science Course	UBSMH301	Mathematics-III	3	1	0	4	30	70	0	100
6	Humanities Science Course	UHSMH307	Engineering Economics	3	0	0	3	30	70	0	100
7	Lab Course	ULCCS301	Data Structure Lab	0	0	3	1.5	0	0	100	100
8	Lab Course	ULCCS302	Object Oriented Programming Lab	0	0	3	1.5	0	0	100	100
			Total				**23**				**800**

4thSEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Core Course	UPCCS401	Algorithm Design & Analysis	3	0	0	3	30	70	0	100
2	Core Course	UPCCS402	Computer Organization & Architecture	3	1	0	4	30	70	0	100
3	Core Course	UPCCS403	Operating Systems	3	0	0	3	30	70	0	100
4	Engg. Science Course	UESCS404	Formal Language & Automata Theory	3	0	0	3	30	70	0	100
5	Humanities Science Course	UHSMH406	Organizational Behavior	3	0	0	3	30	70	0	100
6	Lab Course	ULCCS401	Algorithm Design & Analysis Lab	0	0	3	1.5	0	0	100	100
7	Lab Course	ULCCS402	Computer Organization & Architecture Lab	0	0	3	1.5	0	0	100	100
8	Lab Course	ULCCS403	Operating Systems Lab	0	0	3	1.5	0	0	100	100
9	Mandatory Course	UMCCE401	Environmental Science	2	0	0	0	30	70	0	100
			Total				**20.5**				**900**

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10	**Summer Internship programme (4 to 8 weeks) is mandatory as per AICTE rule**

5thSEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Core Course	UPCCS501	Database management Systems	3	0	0	3	30	70	0	100
2	Core Course	UPCCS502	Computer Networks	3	0	0	3	30	70	0	100
3	Core Course	UPCCS503	Internet & Web Technologies	3	0	0	3	30	70	0	100
4	Core Course	UPCCS504	Artificial Intelligence	3	0	0	3	30	70	0	100
5	Programme Elective-I	UPECS501	Advance Computer Architecture	3	0	0	3	30	70	0	100
		UPECS502	System Programming								
		UPECS503	Image Processing								
6	Open Elective-I			3	0	0	3	30	70	0	100
7	Lab Course	ULCCS501	Database management Systems Lab	0	0	3	1.5	0	0	100	100
8	Lab Course	ULCCS502	Computer Networks Lab	0	0	3	1.5	0	0	100	100
9	Lab Course	ULCCS503	Internet & Web Technologies Lab	0	0	3	1.5	0	0	100	100
			Total				**22.5**				**900**

6thSEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Core Course	UPCCS601	Compiler Design	3	0	0	3	30	70	0	100
2	Core Course	UPCCS602	Software Engineering	3	0	0	3	30	70	0	100
3	Programme Elective-II	UPEIE612	Signal & Systems	3	0	0	3	30	70	0	100
		UPECS602	Embedded Systems								
		UPECS603	Advance Operating Systems								
		UPECS604	Soft Computing								
4	Programme Elective-III	UPECS605	Speech & Natural Language Processing.	3	0	0	3	30	70	0	100

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		UPECS606	Data Mining								
		UPEIE613	Digital Signal Processing								
		UPECS608	Information Theory & Coding.								
5	Open Elective-II			3	0	0	3	30	70	0	100
6	Lab Course	ULCCS601	Compiler Design Lab	0	0	3	1.5	0	0	100	100
7	Lab Course	ULCCS602	Software Engineering Lab	0	0	3	1.5	0	0	100	100
8	Lab Course	ULCCS603	Project -1	0	0	4	2	0	0	100	100
			Total				**20**				**800**
9	**Summer Internship programme (4 to 8 weeks) is mandatory as per AICTE rule**										

7thSEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Programme Elective-IV	UPECS701	Computational Number Theory	3	0	0	3	30	70	0	100
		UPECS702	Quantum Computing								
		UPECS703	Computer Graphics								
		UPECS704	Ad-hoc & Sensor Networks								
2	Programme Elective-V	UPECS705	Cryptography & Network Security	3	0	0	3	30	70	0	100
		UPECS706	Computational Geometry								
		UPECS707	Object Oriented Analysis & Design.								
		UPECS708	Microprocessor & Microcontroller.								
3	Open Elective-III			3	0	0	3	30	70	0	100
4	Open Elective-IV			3	0	0	3	30	70	0	100
5	Humanities Science Course	UHSMH701	Entrepreneurship Development	3	0	0	3	30	70	0	100
6	Project Course	UPRCS701	Project Stage-1	0	0	6	3	0	0	100	100
7	Seminar	USECS701	Internship Seminar	0	0	2	1	0	0	100	100
			Total				**19**				**700**

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8th SEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Programme Elective-VI	UPECS801	Optimization Techniques	3	0	0	3	30	70	0	100
		UPECS802	Cloud Computing								
		UPECS803	VLSI System Design								
2	Open Elective-V			3	0	0	3	30	70	0	100
3	Open Elective-VI			3	0	0	3	30	70	0	100
4	Project Course	UPRCS801	Project Stage-2	0	0	14	7	0	0	100	100
5	Core Course	UPCCS801	Comprehensive Viva-Voce	0	0	2	1	0	0	100	100
			Total				**17**				**500**

OPEN ELECTIVE OFFERED BY OTHER BRANCHES TO "COMPUTERSCIENCEENGINEERING"

OPEN ELECTIVE - I (5TH SEM)

Sl. No	Branch	Subject Code	Subject
1	CIVIL ENGINEERING	UOECE501	Fluid Mechanics
2	ELECTRICAL ENGINEERING	UOEEE501	Industrial Electrical Systems
3	MECHANICAL ENGG.	UOEME501	Thermodynamics and Heat Transfer
		UOEME502	Applied Thermal Engineering
4	INSTRUMENTATION & ELECTRONICS ENGG.	UOEIE501	Digital Communication
5	INFORMATION TECHNOLOGY	UOEIT501	Data Structure
6	BIOTECHNOLOGY	UOEBT501	Physiology for Engineers
7	FASHION TECHNOLOGY	UOEFT501	Fundamental Techniques of Apparel Design
8	TEXTILE ENGG.	UOETE501	Textile Structural composite

OPEN ELECTIVE - II (6TH SEM)

Sl. No	Branch	Subject Code	Subject
1	CIVIL ENGINEERING	UOECE601	Mechanics of Solids
2	ELECTRICAL ENGINEERING	UOEEE601	Renewable Energy Systems

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3	MECHANICAL ENGG.	UOEME601	Basic Manufacturing Process
4	INSTRUMENTATION & ELECTRONICS ENGG.	UOEIE601	MICRO ELECTRO MECHANICAL SYSTEM (MEMS)
5	INFORMATION TECHNOLOGY	UOEIT601	Object Oriented Programming using C++
6	BIOTECHNOLOGY	UOEBT601	Introduction to Biopharmaceutical Technology
7	FASHION TECHNOLOGY	UOEFT601	Visual Art and Illustration Techniques
8	TEXTILE ENGG.	UOETE601	Clothing Science and Technology
OPEN ELECTIVE - III (7TH SEM)			
Sl. No	**Branch**	**Subject Code**	**Subject**
1	CIVIL ENGINEERING	UOECE701	Composite Materials
2	ELECTRICAL ENGINEERING	UOEEE701	Control System Design
3	MECHANICAL ENGG.	UOEME701	Mechanics of Solids
4	INSTRUMENTATION & ELECTRONICS ENGG.	UOEIE701	Satellite Communication
5	INFORMATION TECHNOLOGY	UOEIT701	Java Programming
6	BIOTECHNOLOGY	UOEBT701	Computational Biology
7	FASHION TECHNOLOGY	UOEFT701	Fashion Photography
8	TEXTILE ENGG.	UOETE701	Specialty Yarn and Fabric
OPEN ELECTIVE - IV (7TH SEM)			
Sl. No	**Branch**	**Subject Code**	**Subject**
1	CIVIL ENGINEERING	UOECE702	Solid Waste & Hazardous Waste Management
2	ELECTRICAL ENGINEERING	UOEEE702	Electric & Hybrid Vehicles
3	MECHANICAL ENGG.	UOEME702	Project and Production Management
4	INSTRUMENTATION & ELECTRONICS ENGG.	UOEIE702	Digital Image and Video Processing
5	INFORMATION TECHNOLOGY	UOEIT702	Data Base Engineering
6	BIOTECHNOLOGY	UOEBT702	Industrial Biotechnology
7	FASHION TECHNOLOGY	UOEFT702	Fashion Business and Forecasting
8	TEXTILE ENGG.	UOETE702	Color Measurement
OPEN ELECTIVE - V (8TH SEM)			

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Sl. No	Branch	Subject Code	Subject
1	CIVIL ENGINEERING	UOECE801	Building Materials & Building Constructions
2	ELECTRICAL ENGINEERING	UOEEE801	Electrical Engineering Materials
3	MECHANICAL ENGG.	UOEME801	Fluid Mechanics & Hydraulic Machines
		UOEME802	Mechanism of Machines
4	INSTRUMENTATION & ELECTRONICS ENGG.	UOEIE801	Analog VLSI
5	INFORMATION TECHNOLOGY	UOEIT801	Computer Organization
6	BIOTECHNOLOGY	UOEBT801	Bioseparation Technology
7	FASHION TECHNOLOGY	UOEFT801	Visual Merchandising
8	TEXTILE ENGG.	UOETE801	Application of Nanotechnology in Textile
OPEN ELECTIVE - VI (8TH SEM)			
Sl. No	**Branch**	**Subject Code**	**Subject**
1	CIVIL ENGINEERING	UOECE802	Engineering Geology
		UOECE803	Environmental Impact Assessment
2	ELECTRICAL ENGINEERING	UOEEE802	Power Station Engineering and Economy
		UOEEE803	Electrical Energy Conservation and Auditing
3	MECHANICAL ENGG.	UOEME803	Quality Engineering and Management
4	INSTRUMENTATION & ELECTRONICS ENGG.	UOEIE802	Wireless Sensor Network
5	INFORMATION TECHNOLOGY	UOEIT802	Data Mining
6	BIOTECHNOLOGY	UOEBT802	Tissue Engineering
7	FASHION TECHNOLOGY	UOEFT802	Smart and Functional Apparel
8	TEXTILE ENGG.	UOETE802	Costing of Textile Materials

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DETAILED 4-YEAR CURRICULUM CONTENTS

Undergraduate Degree in Engineering & Technology

Branch/Course: COMPUTER SCIENCE AND ENGINEERING

Year-1st

(1st & 2nd Semester)

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Programming for Problem Solving

Course Objectives :

1. The course aims to provide exposure to problem-solving throughprogramming.
2. It aims to train the student to the basic concepts of the C-programminglanguage.
3. This course involves a lab component which is designed to give the student hands-on experience with theconcepts.

Course Outcomes:

After the course the students are expected to be able to (this is what the exams will test) :

1. Identify situations where computational methods and computers would beuseful.
2. Given a computational problem, identify and abstractthe programming taskinvolved.
3. Approach the programming tasks using techniques learned and writepseudo-code.
4. Choose the right data representation formats based on the requirements of theproblem.
5. Use the comparisons and limitations of the various programming constructs and choose the right one for the task inhand.
6. Write the program on a computer, edit, compile, debug, correct, recompile and runit.
7. Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve thetask.

Module-1:

Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudo code with examples, From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code , Arithmetic expressions and precedence

Module-2:

Conditional Branching and Loops , Arrays (1-D, 2-D), Character arrays and Strings
Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arraystofunctions:idea ofcallbyreference,Recursion,asa different wayofsolvingproblems.

Module-3:

Structure &Unions , Defining structures and Array of Structures, Pointers, Idea of pointers, Defining pointers, Pointers to functions, Double pointers.

Module-4:

Dynamic memory allocation, use of malloc(), calloc(), realloc(), free(). Storage classes: local, global, static & register variables. File handling: reading & writing to a file.

Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C,McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, TataMcGraw-Hill

Reference Books

(i) BrianW. KernighanandDennisM.Ritchie, TheCProgrammingLanguage, Prentice Hall ofIndia

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Programming for Problem Solving Lab

Lab1: Familiarization with programming environment

Lab 2: Simple computational problems using arithmetic expressions

Lab 3: Problems involving if-then-else structures

Lab 4: Iterative problems e.g., sum of series

Lab 5: 1D Array manipulation

Lab 6: Matrix problems, String operations

Lab 7: Simple functions

Lab 8 and 9: Programming for solving Numerical methods problems

Lab 10: Recursive functions

Lab 11: Pointers and structures

Lab 12: File operations

Physics(3-1-0)

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Enhance the fundamental knowledge in Physics and its application relevant to various streams of Engineering andTechnology.
2. Understand interaction of light with matter through interference, diffraction and be able to distinguish ordinary light with a laser light and to realize propagation of lightpolarization.
3. Understand various crystal systems and their structures elaborately through opticalfibers.
4. Understand basic knowledge of quantummechanics.

Module 1: (16 Hours)

Classical Dynamics: Newton's laws of motion, generalized coordinates, constraints, Principle of virtual work,D'Alembert'sPrinciple,Lagrangian,Actionprinciple,Lagrangeequationofmotion(noderivation) and its application to Simple Harmonic oscillator and simplependulum.

General properties of Matter: Stress, Strain, Hooks' law, Young's modulus.
Oscillation & Waves: Simple Harmonic Oscillation, damped harmonic oscillation, forced oscillator, resonance, coupled oscillation, concept of wave and wave equation.

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Optics: Concept of interference, two source interference pattern, Biprism, Michelson Interferometer & measurementofwavelength.Diffraction:Huygensprinciple,Fresnel&Fraunhoferdiffraction,Zoneplate, Plane diffraction grating (formulaonly).

Module 2: (12 Hours)

Solid State Physics: Crystalline and amorphous solid, unit cell, Miller Indices, Reciprocal lattice, Bragg's law, Brillouin's zone, concept of fermions, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distribution function (only statement and formula), Concept of Fermions and Bosons. Classification of materials: metals, semiconductor and insulator in terms of band theory.

LASER and Fibre Optics: Principle and application, stimulated emission, population inversion, Lasing material (solid and gas), He-Ne laser, Rubi- LASER, Application of LASER (Engineering Application), Principle of optical fibre and its application to communication.

Module 3: (12 Hours)

Electromagnetism: Student will be familiarized with some basics used in vector calculus prior to development of Maxwell's electromagnetic wave equations. No proof of theorems and laws included in this unit expected-statement and interpretation should sufficient.

a) Vector calculus: gradient of scalar field, divergence, curl of vector field (Only Physical significance) Gauss divergence theorem, Stoke's theorem, Green's theorem (Only Statements) and applications.

b) Gauss's law of electrostatics in free space and in a medium and application (Only statements) electric displacement (D) magnetic Induction (B), Amperes circuital law (Only statements), displacement current,Faraday'slawofelectromagneticinduction(Onlystatements),BiotSavartsLaw(Onlystatements), Maxwell's four electromagnetic equations, Wave equation for E and B fields in vacuum, Electromagnetic energy, Poynting vector (noderivation).

Quantum Physics: Elementary concepts of quantum physics formulation to deal with physical systems.

a) Need for Quantum Physics-Historical overviews, Particle aspects of radiation- Black body radiation, photoelectric effect, Compton scattering, pair production. (No derivations), Wave aspect of particles-matterwave,deBroglieHypothesis,HeisenbergUncertaintyprinciples-Statement,Interpretation and application to H-atom, Harmonic oscillator to calculate ground stateenergy.

b) Basic features of Quantum mechanics- Transition from deterministic to probabilistic, States of system-Wavefunction,probabilitydensity,superpositionprinciple,observablesandoperators,expectation values. Schrodinger equation- Time dependent and time independent, wavepackets.

Text Books:

1. L. Maharana, P. K. Panda, S. N. Dash, B. Ojha, Lectures in Engineering Physics,Pearson.

Reference Books:

1. An Introduction to Mechanics -D. Klippner& R. Kolenkow,TMH
2. Concepts of Modern Physics - ArthurBeiser.
3. Electricity & Magnetism -E. M.Purecell
4. Engineering Physics by D. K. Bhattacharya and Poonam Tandon, Oxford UniversityPress

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5. Engineering Physics by D. R. Joshi, Mc GrawHill
6. Introduction to Electrodynamics- David J. Griffiths, PHIPublication
7. Optics- A. K.Ghatak
8. Physics-I for engineering degree students- B. B. Swain and P. K.Jena.
9. Quantum Mechanics -Powel &Craseman.
10. Quantum Physics -Gasiorowicz

Basic ElectricalEngineering(3-1-0)

This is a foundation course aimed to expose the students the basic and under- lying principles ofElectrical circuits, Electro-mechanical energy conversion andMeasurements.

Course Outcomes

At the end of this course, students will be able to:

1. Understand and analyse basic electric and magneticcircuits.
2. Analysis of Transient condition in DCcircuit.
3. Understand the basic of various types of electrical machines andmeasurements.
4. Explain the under-laying principle of generation, transmission and distribution of the electrical power.

Module 1: (10 Hours)

Fundamentals of Electric Circuits: Fundamentals of electrical circuit, Ohm's law, Kirchhoff's laws, series and parallel connections, Electric Power and sign conventions, circuit elements and their characteristics. Practical voltage and current sources. Source Conversion.

ResistiveNetworkAnalysis:nodevoltageandmeshcurrentmethods,supernodeandsupermeshmethods, delta-starandstar-deltaconversions,superpositionprinciple,Thevenin'sandNorton'stheorems.maximum powertransfer.

Module 2: (10 Hours)

Single phase AC circuits: Single phase emf generation, Representation of sinusoidal waveforms, average, effective, peak and rms values, j operators, phasor concept, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel) Instantaneous Power in AC Circuits, Real power, reactive power, apparent power, Power Factor, Power triangle, Complex Power.

Three-phase AC circuits: Three phase emf generation, Delta-star and star- delta conversions, voltage and

currentrelationsinstaranddeltaconnections.solutionofthethreephasecircuitswithbalancedvoltageand balanced load conditions, phasor diagram, measurement of power in three phasecircuits.

Transient Analysis: Writing differential equations for circuits, DC steady state solutions of first order circuits.

Module 3: (10 Hours)

ElectricalMeasuringinstruments:Introduction,PMMCAmmetersandVoltmeterswithextensionofrange, Moving-Iron Ammeters and Voltmeters, Dynamometer type Wattmeter, Energymeter.

Magneticcircuits:MMF,flux,reluctance,inductance.ReviewofAmpereLaw,BiotSavartLaw.Magnetic field, Electricity and Magnetism, B-H characteristics and hysteresis loss, series and parallel magnetic circuits.

Transformers:Construction,operatingprinciple,emfequationandturnsratio.Typesoftransformer,phasor diagrams for no loadoperation.

Module 4: (10 Hours)

DCMachines:PrincipleofOperationofgeneratorandmotor,EMFequation,TorqueEquation,methodsof excitation. Speed equation of d.c. motor, speed control of d.c. shuntmotor.

Induction motor: construction of AC inductor machines, Revolving magnetic flux, torque and slip, synchronous speed.

Power Systems: Brief idea about various generating plants (Thermal, Hydel, and Nuclear), Transmission and Distribution of Electric Energy.

Text Books:

1. Electrical & Electronic Technology, E. Huges, Pearson, 9thEdition.
2. Electrical Engineering Fundamentals, Vincent Del Toro, 2nd Edition,PHI.

Reference Books:

1. C. L. Wadhwa," Electrical Engineering", New Age International Publishers, 2ndEdition.
2. Basic Electrical Engineering, A. Fitzgerald, D. E. Higginbotham and A. Grabel, TMH, 5thEd.

English(2-0-0)

Course Outcome

At the end of this course, students will be able to:

1. Equipped with the theory and practice ofcommunication.
2. Equipped with both theoretical vocabulary and basic tools which will help them develop as better communicators.

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Select literary texts and establish how these texts contribute to the afore- mentionedobjectives

Module 1: (08 Hours)

Introduction to Communication:

Importance of Communication in English, the process of communication and factors that influence the process of communication: Sender, receiver, channel, code, topic, message, context, feedback, 'noise'. Principles of Communication. Barriers to Communication & Communication Apprehension, Verbal (Spoken and Written) and non-verbal communication, Body language and its importance in communication.

Module 2: (07 Hours)

Phonetics and Functional Grammar:

Sounds of English: Vowels (Monophthongs and Diphthongs), Consonants, Syllable division, stress (word, contrastive stress) & intonation, MTI and problem sounds, Review of Parts of Speech, Subject and Predicate, Tense, Voice Change, Idioms and Phrasal Verbs.

(Note:Thisunitshouldbetaughtinasimple,non-technical,applicationorientedmanner,avoidingtechnical terms as fast aspossible.)

Module 3: (05 Hours) Reading

Literature:

Prose:

- Stephen Leacock: My Financialcareer.
- Mahatma Gandhi: from My Experiments withTruth.
- O'Henry: The Last Leaf.

Poetry:

- Nissim Ezekiel:Professor.
- Jack Prelutsky: Be glad your nose is on yourface.
- Maya Angelou: Still I rise(Abridged).

PhysicsLab(0-0-3)

List of Experiments

(At least 10 experiments should be done)

Experiment List:

1. Determination of Young's modulus by Searle's method / Bending ofbeams.
2. Determination of Rigidity modulus by staticmethod.

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3. Determination of surface tension by capillary risemethod.
4. Determination of acceleration due to gravity by Bar / Kater'spendulum.
5. Verification of laws of vibration of string usingsonometer.
6. Determination of wavelength of light by Newton's ringapparatus.
7. Determination of grating element of a diffractiongrating.
8. Determination of wavelength of laser source by diffraction ratingmethod.
9. Determination of wavelength using MichelsonInterferometer.
10. Plotting of characteristic curve of a PN junctiondiode.
11. Plotting of characteristic curves ofBJT.
12. Determination of unknown resistance using MeterBridge.
13. Determine of reduction factor of the given tangentgalvanometer.
14. Determination of horizontal component of earth's magnetic field by using tangentgalvanometer.
15. Determination of Hall coefficient using Hallapparatus.

Basic Electrical EngineeringLab(0-0-2)

List of Experiments

(At least 10 experiments should be done)

Course Outcomes

At the end of the course the students are able to:

1. Learn about the working of different measuring instruments for measuring power, power factor, energyetc.
2. Verify different NetworkTheorems
3. Draw the Open Circuit Characteristics of dc generator andTransformer
4. Visualize the constructional details of differentmachines

Experiment List:

1. Basic safety precautions. Introduction and use of measuring instruments - voltmeter, ammeter, wattmeter, Rheostat, multi-meter,oscilloscope.

2. Connection and measurement of power consumption of an Incandescent, fluorescent, LED and CFL lamp and determination of power factor.

3. Power and power factor measurements in three phase system by two wattmetermethod.

4. Verification of super position, Thevenin and Norton'stheorem.

5. Plotting of B-H curve of different magnetic material and calculation of hysteresisloss.

6. Testing of a single-phase energy meter at different powerfactor.

7. Calculation of power and power factor in series R-L-C circuit excited by single-phase AC supply and draw the phasor diagram.

8. Determination of open circuit characteristics (OCC) of DC shuntgenerator.

9. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change involtage.

10. Observationoftheno-loadcurrentwaveformofatransformeronanoscilloscopeandmeasurement of primary and secondary voltages and currents, and power at differentload.

11. Demonstration of cut-out sections of machines: dc machine (commutator- brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ringarrangement).

Workshop/Basic ManufacturingPractices(1-0-4)

Module 1: (05 Hours)

Engineering materials: Classification of Engineering materials. Mechanical properties of Steel,Aluminum andPlastics.

Safety precautions in workshop.

Fitting: Knowledge of hand tools: V-block, Marking Gauge, Files, Hack Saw, Drills, Taps, Types of fitting.

Module 2: (05 Hours)

Welding: Study of electric arc welding tools &equipments, Models: Butt Joint, Lap Joint, T joint & L- joint.

Machining: Introduction to different machine tools: Lathe machine, Shaper machine and milling machine. Brief introduction to other basic manufacturing processes like foundry, sheet metal operation and forming processes.

Text Books:

1. Elements of Workshop Technology, Vol. I and II by Hajrachoudhary, KhannaPublishers.

2. Workshop Technology by W. A. J. Chapman, VivaBooks.

3. Workshop Manual by Kannaiah/ Narayana,Scitech.

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EnglishLab(0-0-2)

List of Experiments

(All the experiments should be done)

Course Outcome:

At the end of the course the students are able to:

1. Acquaintedwiththeirstrengthandweaknessinexpressingthemselves,theirinterestsandacademic habits.
2. ImproveskillsofLSRW(Listening,Speaking,ReadingandWriting)throughmutualconversation and activities related to theseskills.
3. Promote the creative and imaginative practices before theteacher-trainer.

Lab sessions will give a platform for the students to indulge in activities based on the first two modules of theorytaughtintheclassroom.Allthelabclasseswillbedividedinsuchamannerthatallthefouraspects of language (LSRW) arecovered.

Experiment List:

1. Speaking: Ice-breaking and Introducing each other, Writing: Happiest and saddest moment of my life.
2. Listening: Listening practice (ear training): News clips, Movie clips, Presentation, Lecture or speech by a speaker, Speaking:Debate.
3. Reading: Reading comprehension, Writing: Creative writing (Short story: Hints to be given by teacher).
4. Reading:TopicsofGeneralawareness,CommonerrorsinEnglishusage,Writing:Constructionof different types ofsentences.
5. Speaking: Practice of vowel and consonant sounds, Writing: Practice of syllabledivision.
6. Speaking: My experience in the college/ or any other topic as per the convenience of the student, Writing: Phonemic transcription practice.
7. Listening: Practice of phonetics through ISIL system and also with the help of a dictionary, Speaking: Role-play ingroups.
8. Speaking: Practice sessions on Stress and Intonation, Writing: Practice sessions on Grammar (Tense and voicechange).
9. Speaking: Extempore, Writing: Framing sentences using phrasal verbs andidioms.
10. Watching a short English Movie, Writing: Critical analysis of themovie.

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End-termAssignment:Studentsarerequiredtomakeaprojectofatleast5pagesonatopiconthefollowing broad streams: Technology, General awareness, Gender, Environment, Cinema, Books and the like. The assignment should involve data collection, analysis andreporting.

Mathematics-I(3-1-0)

Course Outcomes

On successful completion of this course, the students will be able to:

1. Applytheprinciplesofdifferentialcalculustosolveavarietyofpracticalproblemsinengineering and appliedsciences.
2. Possess fundamental understanding of Fourier series and be able to give Fourier expansions of a function,
3. Apply the principles of vector calculus to solve a variety of basic problems in engineering and appliedscience,
4. Solve a variety of first order and higher order differential equations selecting from a variety of techniques covered in thesyllabus.

Module 1: (10 Hours)

Calculus:Asymptote,Curvature,Convergenceofsequenceandseries,testsforconvergence,powerseries, Taylor's series, Fourierseries.

Partialdifferentiation,Taylor'stheoremforfunctionoftwovariables,MaximaandMinimaforfunctionof twovariables.

Module 2: (10 Hours)

Vector differential calculus: vector and scalar functions and fields, Derivatives, Curves, tangents and arc length, gradient, divergence, curl.

Vector integral calculus: Line Integrals, Green Theorem, Surface integrals, Gauss theorem and Stokes Theorem.

Module 3: (10 Hours)

Differential Equation: Differential Equation: First order differential equations, Separable Equation, Exact differentialequation,lineardifferentialequation,Bernoulli'sequationandapplicationtoElectricalcircuits.

Lineardifferentialequationofsecondandhigherorder,Homogeneousequationwithconstantco-efficient, Euler-Cauchy equations, Solution by undetermined co-efficient, Solutions by variation of parameters, Modelling of electriccircuits.

Module 4: (10 Hours)

Series solution of differential equations, Power series method, Legendre equation and Legendre polynomials.

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Laplace transformation and its use in getting solution to differential equations, Convolution, Integral Equations.

Text Books:

1. Differential Calculus by Santi Narayan and Mittal, Chapters 14, 15Publication.
2. Advanced Engineering Mathematics by E. Kreyszig, Tenth Edition,Wiley.
3. Higher Engineering Mathematics by B. V. Raman, McGraw HillsEducation.

Reference Books:

1. Engineering Mathematics by Pal and S. Bhunia, OxfordPublication.
2. Ordinary and Partial Differential equations by J. Sinha Roy and S. Padhy, KalyaniPublishers.
3. Advance Engineering Mathematics by P. V. O'Neil,Cengage.

Basic Electronics Engineering

Module 1: (12 Hours)

Semiconductor Diodes:

Semiconductor materials- intrinsic and extrinsic types, Ideal Diode, Terminal characteristics of diodes (p-n junction under open circuit condition, p-n junction under forward bias and reverse bias condition)p-n junction in breakdown region, Diode small signal model, Zener diode and applications , Rectifier Circuits (Half wave, Full wave centre tap and bridge rectifiers)

Bipolar Junction Transistors (BJTs):

Physical structure and operation modes**,** Active region operation of transistor**,** D.C. analysis of transistor circuits**,** Transistor as an amplifier**,**

Module 2: (12 Hours)

BJT Biasing and Modeling:

Biasing the BJT: fixed bias, emitter feedback bias and voltage divider bias**,** Basic BJT amplifier configuration: common emitter, common base andcommon collector amplifiers

Field Effect Transistor:

JFET-types, Operations and their Characteristics ,MOSFETs- types, Operations and their Characteristics

Feedback Amplifiers and Oscillators:

Types of feedback, Advantages of Negative feedback, Barkhausen criterion, RC oscillators (phase shift, Wien bridge), LC oscillators (Hartley)

Extra (To be taught in Department level)

Transistor as a switch: cut-off and saturation modes, High frequency model of BJT amplifier.

Operation Amplifier (Op-amps):

Ideal Op-amp, Differential amplifier: differential and common mode operation, common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non -inverting amplifier, weightedsummer, integrator, differentiator

Reference Books:

1. A. S. Sedra and K. C. Smith, *Microelectronic Circuits: Theory and Applications*, 7th edition. Oxford, 2017.
2. B. Razavi, *Fundamentals of Microelectronics*, 2nd edition. Wiley-India, 2014.
3. R. L. Boylestad and L. Nashelsky, *Electronic Devices and Circuit Theory*, 11th edition. Pearson, 2013.

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4. T. C. Carusone, D. Johns, and K. Martin, *Analog Integrated Circuit Design*, 2nd edition. Wiley-India, 2013.
5. P. R. Gray, P. J. Hurst, S. H. Lewis, and R. G. Meyer, *Analysis and Design of Analog Integrated Circuits*, 5th edition. Wiley-India, 2009.
6. D. A. Neamen, *Electronic Circuits: Analysis and Design*, 3rd edition. Tata McGraw-Hill, 2008.

Basic Electronics Laboratory Experiment List

List of Experiments

(At least 5 Experiments Should be done)

Sl No.	Name of the Experiment	Week
1	Familiarization with electronic components&equipment's (Active & Passive, Multi-meters, CROs and function generators)	1
2	Study of the characteristics of P-N junction diode and finding dynamic resistance.	2
3	Construction of half-wave rectifier and full wave rectifier circuits & study of their output waveforms by CRO and calculation of efficiency and ripple factor.	3
4	Study of the output characteristics of a Common Emitter Transistor	4
5	Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.	5
6	Study of the characteristics of Zenerdiode.	6
7	Construction of clipper circuits & study of their output waveforms of positive clipper, negative clipper and two level clipper by CRO.	7
8	Construction of clamper circuits & study of their output waveforms of positive clamping, negative clamping by CRO.	8

Chemistry(3-1-0)

Course Outcomes

At the end of this course, students will be able to:

1. Understand the basics of molecularinteractions.
2. Idea about organometallic and their catalyticapplications.
3. Understand basics of fuels and corrosionchemistry.

Module 1: (10 Hours)

QuantumChemistryandSpectroscopy:Basicconceptsandpostulatesofquantummechanics.Introduction to Schrodinger Wave Equation, Particle in a box: Energy levels, quantum numbers and selectionrule.

Spectroscopy: Lambert Beer's Law, Principles and applications of UV-Visible Molecular Absorption Spectroscopy; Chromophores, applications to colorimetry. Effect of conjugation on chromophores, Absorption by aromatic systems, introductory idea on Rotational and Vibrational Spectroscopy Principles and application to diatomic molecules.

The phase rule: Statement of Gibb's phase rule and explanation of the terms involved, Phase diagram of onecomponentsystem-waterandsulfursystem,Condensedphaserule,Phasediagramoftwocomponent system - Eutectic Bi-Cdsystem

Module 2: (10 Hours)

Organometallics: Introduction to organometallics, EAN rule; classification, nomenclature and characteristics of organometallic compounds. Applications of organometallic compounds and catalyst in alkene isomerization hydrogenation and hydroformylation (detail mechanisms are to be excluded).

Module 3: (10 Hours)

Fuels: Classification of fuels, calorific value. (Determination by Dulong's formula), G. C. V. and N. C. V. Liquid fuels: Classification of petroleum, refining of petroleum, Cracking, Knocking and anti-knocking, cetane and octane numbers. Unleaded petrol, synthetic petrol, power alcohol. Gaseous Fuel: Producer gas, Water gas, LPG, CNG, Kerosene gas, Combustion calculation.

Module 4: (10 Hours)

Corrosion: Electrochemical theory of corrosion, galvanic series, Types of corrosion; Differential metal corrosion, Differential aeration corrosion (Pitting and water line corrosion), Stress corrosion (caustic embrittlementinboilers),Factorsaffecting,Metalcoatings-GalvanizingandTiming,Corrosioninhibitors, cathodicprotection.

Text Books:

1. Text Book in Applied Chemistry by A. N. Acharya and B. Samantaray, PearsonIndia.
2. Introductory to Quantum Chemistry by A. K. Chandra, 4th Edition, McGraw HillEducation.
3. Fundamentals of Molecular & Spectroscopy by Banwell, Tata McGraw HillEducation.
4. Physical Chemistry by Gordon M. Barrow,McGraw-Hill
5. Engineering Chemistry, 12th Edition, Author: Wiley India Editorial Team PublishersWiley.
6. Engineering Chemistry: Fundamentals and Applications. Shikha Agarwal. Cambridge University Press.
7. Engineering Chemistry, Jain and Jain, Dhanpat RaiPublication.

Reference Books:

1. Inorganic Chemistry by Donald A. Tarr, Gary Miessler, Pearson India, ThirdEdition.
2. Quantum Chemistry by Ira N. Levine, Pearson 7thEdition.
3. Molecular Spectroscopy, Ira N. Levine, John Wiley andSons
4. Modern Spectroscopy - A Molecular Approach, by Donald McQuarrie and John Simon,published by University ScienceBooks.
5. Inorganic Chemistry by W. Overton, Rounk and Armstrong, Oxford University Press, 6thedition.

ChemistryLab(0-0-3)

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List of Experiments

(At least 10 experiments should be done)

Experiment List:

1. Determination of amount of sodium hydroxide and sodium carbonate in amixture.
2. Determination of total hardness of water by EDTAmethod.
3. Estimation of calcium in calcium inlimestone.
4. Determination of percentage of available chlorine in a sample of bleachingpowder.
5. Preparation ofPhenolphthalein.
6. Acid-Base Titration byPotentiometry.
7. Preparation of buffer solution and determination of pH of a buffersolution.
8. Standardization of KMnO4 using sodium oxalate. Determination of ferrous iron in Mohr's salt by potassiumpermanganate.
9. Determination of partition coefficients of iodine between benzene andwater.
10. Determination of rate constant of acid catalyzed hydrolysisreaction.
11. Determination of concentration of a colored substance byspectrophotometer.
12. Determination of dissolved oxygen in a sample ofwater.
13. Determination of Viscosity of a lubricating oil by Red Woodviscometer.
14. Determination of Flash point of a given oil by Pensky-Marten's flash pointapproach.
15. Determination of Critical Micelle concentration (CMC) of an ionic surfactant (Both cationic and anionic).

Engineering Graphics and Design (1-0-4)

Module 1: (05 Hours)

Introduction: Introduction to Engineering Drawing, Drawing Instruments and their uses, Dimensioning, Scale, types of lines, Lettering. (1 sheet)

Orthographic Projection: Introduction to Projection, Projection types or methods (First angle and Third angle)

PlaneofProjection,Referenceline,orthographicProjectionofPoints(pointslocatedinallfourquadrants), Projection of Straight lines (first and third quad- rant only), traces of lines. (1sheet)

Orthographic Projection of Plane Surfaces in various positions (Triangle, Square, Rectangle, Rhombus, Pentagon, hexagon and Circle), Traces of a Plane. (1 sheet)

Introduction to Solids and Types of Solids, Orthographic Projection of Solids in different Positions. (1 sheet)

Module 2: (05 Hours)

Sections and Development of Lateral Surface of Solids: Sectional view (half section and full section), development of surfaces of right regular prisms, pyramids, cylinders and cones. (1 sheet)

Isometric Projection: Introduction, Isometric Scale, Isomeric projection of cube, right regular prism, cylinders and cones. (1 sheet)

Applications: Orthographic and sectional view of Machine components (Screw Thread, nut and bolt). (1 Sheet)

Auto CAD: Introduction to Auto CAD. Fundamental concepts.

Text Books:

1. Machine Drawing by N. D. Bhatt, V. M. Panchal, Charotar PublishingHouse.
2. Machine Drawing by N. D. Junarkar, PearsonEducation.
3. Machine Drawing with AutoCAD by GoutamPohit and Goutam Ghosh, PearsonEducation.

Machine Drawing includes AutoCAD by Ajeet Singh, Tata McGrawHill

Mathematics-II(3-1-0)

Course Outcome:

On successful completion of this course, the students will be able to:

1. Use the basic concepts of vector and matrix algebra, including linear dependence / independence, basisanddimensionofasubspace,rankandnullityforanalysisofmatricesandsystemsoflinearequations,
2. Apply linear algebra techniques to solve various engineeringproblems,
3. Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational re-sources,
4. Compare different numerical methods with respect to accuracy and efficiency of thesolution.

Module 1: (10 Hours)

Matrices, vectors: addition and scalar multiplication, matrix multiplication: Linear systems of equations, linear independence, rank of a matrix, determinants, Cramer's rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Vector space, linear dependence of vectors, basis, dimension.

Module 2: (10 Hours)

Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, matrix associated with a linear map.

Eigenvalues, eigenvectors, symmetric, skew-symmetric and orthogonal matrices, Eigen basis,

Diagonalization, Inner product spaces, Gram-Schmidt orthogonalization.

Module 3: (10 Hours)

Solution of polynomial and transcendental equations - Bisection method, Newton- Raphson methods and Regula-Falsi method.

Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical approximation of functions.

Module 4: (10 Hours)

Numerical differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, Gauss Legendre and Gauss quadrature rule.

Gauss Siedel iteration method for solving a system of linear equations Euler and modified Euler's methods, Runge-Kutta methods.

Text Books:

1. Advanced Engineering Mathematics by E. Kreyszig, John Willey & Sons Inc. 10thEdition
2. Linear algebra and its applications by Gilbert Strang, Cengagelearning.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, McGraw Hill Edu-cation.
2. Engineering Mathematics by Pal and S. Bhunia, OxfordPublication.
3. Advance Engineering Mathematics by P. V.O'Neil.
4. Introductory methods of numerical analysis by S. S. Sastry,PHI.

SYLLABUS FOR COMPUTER SCIENCE & ENGINEERING
B.TECH (AUTONOMOUS)
DURATION: 4 YEARS (EIGHT SEMESTERS)

DETAILED 4-YEAR CURRICULUMCONTENTS

Undergraduate Degree in Engineering &Technology

Branch/Course: COMPUTER SCIENCE AND ENGINEERING

Year-2nd

(3rd& 4thSemester)

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Discrete Structures

Module-1:
Introduction to proofs, Proof methods and strategy, Mathematical induction, Strong induction and well ordering, The basics of counting, The pigeonhole principle, Inclusion and exclusion principle and its applications.

Module-2:
Recurrence relations, Solving linear recurrence relations, Generating functions, Solving recurrence relation by generatingfunctions.
Graphs and graph models, Graph terminology and special types of graphs, Matrix representation of graphs and graph isomorphism, Connectivity, Euler and Hamilton paths. Tree: Binary tree, Searching, Tree traversal, Spanning Tree, DFS, Minimum SpanningTree.

Module-3:
Algebraic systems, Semi groups and monoids, Groups , Subgroups, Homomorphism's, Normal subgroup and cosets , Lagrange's theorem, Definitions and examples of Rings and Fields.
Partial ordering, Posets, Lattices as posets, Properties of lattices, Lattices as algebraic systems, Sub lattices, Direct product and homomorphism, Boolean algebra.

TEXT BOOKS:

1. **Kenneth H.Rosen**, "Discrete Mathematics and its Applications", 7th Edition, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. **C. L. Liu and D. Mohaptra**, "Elements of Discrete Mathematics", Third Edition, 2008, Tata McGraw Hill Education, New Delhi

REFERENCES:

1. Ralph.P.Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi,2007.
2. Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications,2006.
3. Seymour Lipschutz and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 3rd Edition,2010.

Mathematics-III (PROBABILITY AND STATISTICS)

Course Objectives:

1. To give an exposure to the students the basic concepts of Probability and Statistical methods and theirapplication.
2. To use appropriate statistical terms to describedata.
3. To use appropriate statistical methods to collect, organize, display and analyze relevantdata.
4. To serve as a foundation to analyze problems in Science and Engineering applications through Statistical testingMethod.

Syllabus:
ModuleI

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Probability: Introduction, Probability of an event, additive rule & multiplication rule, conditional probability, Bayes' rule, random variable, discrete and continuous probability distribution, Joint probability distribution, Mathematical expectations, Variance and Co- variance of random variables, Mean and Co- variance of linear combination of random variables, Chebyshev theorem,

Module II

Discrete Probability Distribution: Binomial & Multinomial, Hyper-geometric, Geometric, Poisson distribution.

Continuous Probability Distribution: Uniform , Normal , Exponential Distribution, Weibull's Distribution, Chi-square Distribution, Sampling Distribution: Sampling Distribution of S^2, t Distribution, FDistribution.

Module III

Estimation of parameter: methods of estimation, Estimating the mean of a single sample, Standard error, Prediction interval, Tolerance limits, Estimating the difference between means of two samples, Estimating proportion and variance of single sample, Estimating the difference between two proportions and variances of two samples, maximum likelihood estimation.

Module IV

Testing of hypothesis: one and two tailed test, test on a single mean when variance is known & variance is unknown. Test on two means, test on single mean and two mean populations. One and two sample test for variance. χ^2test for goodness of fit and test forindependence.

Introduction to linear regression: Simple regression models, method of least squares, Properties of least square estimators, Inferences concerning the regression coefficients, Coefficients of determination and its application.

Statistical quality control (Simple Idea only)

Text Books :

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers & Keying Ye, "Probability & Statistics for Engineers & Scientists", Eighth Edition, 2007, Pearson Education Inc., NewDelhi.
2. Jay L. Devore, "Probability and Statistics for Engineering and Sciences", Seventh Edition, Thomson/CENGAGE Learning India Pvt.Ltd

Reference books:

1. William Mendenhall, Robert J. Beaver & Barbara M. Beaver, "Introduction to Probability and Statistics", 13th Edition, 2009, CENGAGE Learning India Pvt. Ltd., NewDelhi.
2. T. Veerarajan," Probability, Statistics and Random Processes", Tata McGrawHill
3. Ronald Deep, " Probability and Statistics", AcademicPress

Course Outcomes: On successful completion of this course, the students will be able to

1. have a fundamental knowledge of the concepts of probabilitytheory,
2. do correlation and regression and fitting of different types ofcurves,

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3. apply sampling theory and theory of estimation in various engineering problems and do various tests of hypothesis andsignificance,
4. use calculators and tables to perform simple statistical analyses for small samples and use popular statistics packages, such as SAS, SPSS, S-Plus, R or MATLAB to perform simple and sophisticated analyses for largesamples.

Data Structures

Course Objectives:

1 Understand and remember algorithms and its analysisprocedure.
2 Introduce the concept of data structures through ADT including List, Stack, Queues.
3 To design and implement various data structurealgorithms.
4 To introduce various techniques for representation of the data in the realworld.
5 To develop application using data structure algorithms. 6 Compute the complexity of variousalgorithms

Course Outcomes:

1 Select appropriate data structures as applied to specified problemdefinition.
2 Implement operations like searching, insertion, and deletion, traversing mechanism etc. on various data structures.
3 Students will be able to implement Linear and Non-Linear data structures.
4 Implement appropriate sorting/searching technique for givenproblem.
5 Design advance data structure using NonLinear data structure.
6 Determine and analyze the complexity of given Algorithms.

Module 1:

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure **Stacks and Queues**: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding
algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module 2:

Linked Lists: Singly linked lists: Representation in memory, Algorithmsof several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations. **Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations oneach of the trees and their algorithms with complexity analysis. Applications of Binary Trees. BTree.

Module 3:

Sorting and Searching: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. **Searching:** Linear & binary search **Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms and complexityanalysis.

Suggested text books:

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, SartajSahni, Computer SciencePress.

Suggested reference books:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley PublishingCompany
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, PearsonEducation.
3. Carrano, F. M., **Data Abstraction and Problem Solving with C++**, Benjamin Cummings,1995.
4. Tenenbaum, A. M. ,Langsam, Augenstein, M. J., **Data Structures Using C++**, Prentice Hall, 1996.
5. Kruse, Tondo and Leung, **Data Structures and Program Design in C**, 2nd edition, Prentice-Hall,1997.
6. Lipschuts S., Theory and Problems of Data Structures, Schaum's Series,1986.

Data Structure Lab

1. Programs on linear & binarysearch.
2. Programs onstack.
3. Programs onqueue.
4. Programs on infix to postfixconversion.
5. Programs on evaluation of postfixexpression.
6. Programs on 1-way linkedlist.
7. Programs on 2-way linkedlist.
8. Programs on binary searchtree.
9. Programs on graphtraversal.
10. Programs on sortingtechniques.

Object Oriented Programming

MODULE I: (10 hours)

Introduction to object oriented programming, User defined types. Structures, Unions. Polymorphism, Encapsulation. Getting started with C++ syntax, Data-type, Variables, Strings. Functions, default values in functions, Recursion. Namespaces, Operators, Flow control. Arrays and Pointers. Abstraction mechanism: Classes, Private, Public, Protected. Member data, Member functions, Inline function, Friend functions, Static members, References. Constructors, Destructors.

MODULE II: (10 hours)

Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance. Role of virtual base class, constructor and destructor execution, Base initialization. Local & global objects, implicit & explicit call to constructor. Polymorphism: Binding, Static binding, Dynamic binding, Function Overloading, Ambiguity in function overloading, Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes. Operator overloading: unary operator overloading, binary operator overloading, This pointer, Operator function, member andnon

member operator function.

MODULE III: (10 hours)

Operator overloading, I/O operators, Type conversion, Exception handling.
Dynamic memory management, new and delete operators, Object copying, Copy constructor, Assignment operator, Virtual destructor, Template: Template classes, Template functions. Namespace: User defined Namespaces, Namespaces provided by library.

Text Books:

1. C++: The Complete Reference- Schildt, McGraw-Hill Education(India)
2. ANSI and Turbo C++ - Ashoke N. Kamthane, PearsonEducation

Reference Books:

1. Big C++ - WileyIndia
2. "C++ and Object Oriented Programming" - Jana, PHILearning.
3. "Object Oriented Programming with C++ "- Rajiv Sahay,Oxford
4. Mastering C++ - Venugopal, McGraw-Hill Education(India)

Object Oriented Programming Lab

1. Programs on concept of classes andobjects.
2. Programs usinginheritance.
3. Programs using staticpolymorphism.
4. Programs on dynamicpolymorphism.
5. Programs on operator overloading.
6. Programs on dynamic memory management using new, deleteoperators.
7. Programs on copy constructor and usage of assignmentoperator.
8. Programs on exceptionhandling.
9. Programs on generic programming using template function & templateclass.
10. Programs on filehandling.

Discrete Structures

Module-1:

Introduction to proofs, Proof methods and strategy, Mathematical induction, Strong induction and well ordering, The basics of counting, The pigeonhole principle, Inclusion and exclusion principle and its applications.

Module-2:

Recurrence relations , Solving linear recurrence relations , Generating functions, Solving recurrence relation by generating functions. Graphs and graph models, Graph terminology and special types of graphs, Matrix representation of graphs and graph isomorphism, Connectivity, Euler and Hamilton paths.

Module-3:

Algebraic systems, Semi groups and monoids, Groups , Subgroups, Homomorphism's, Normal subgroup and cosets , Lagrange's theorem, Definitions and examples of Rings and Fields. Partial ordering, Posets, Lattices as posets, Properties of lattices, Lattices as algebraic systems, Sub lattices, Direct product and homomorphism, Boolean algebra.

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TEXT BOOKS:

1. **Kenneth H.Rosen**, "Discrete Mathematics and its Applications", 7th Edition, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. **Tremblay J.P. and Manohar R**, "Discrete Mathematical Structures with Applications to Computer Science", Tata Mc Graw Hill Pub. Co. Ltd, New Delhi, 30th Reprint,2011.
3. **C. L. Liu and D. Mohaptra**, "Elements of Discrete Mathematics", Third Edition, 2008, Tata McGraw Hill Education, New Delhi

REFERENCES:

1. Ralph.P.Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi,2007.
2. Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications,2006.
3. Seymour Lipschutz and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 3rd Edition,2010.

Algorithm Design & Analysis

Module- I

Introduction: Characteristics of algorithm, Time and space complexity, Growth of Functions: Asymptotic analysis, standard notations and common functions, Recurrences: substitution method, recursion tree method and Master methods, Algorithm design strategies, Divide and conquer approach: Merge sort, Quick sort and its performance analysis.

Module – II

Greedy Algorithms, Elements of Greedy strategy, Activity selection Problem, Fractional knapsack problem, Huffman codes, Dynamic programming methodology, Elements of dynamic programming, Assembly scheduling problem, Matrix-chain multiplication, Longest common subsequence.

Module – III

Graph Algorithms and their characteristics, Breadth first search and depth-first search, Minimum Spanning Trees, Kruskal algorithm and Prim's algorithms, single- source shortest paths (Bellman-ford algorithm and Dijkstra's algorithms), All-pairs shortest paths (Floyd – WarshallAlgorithm).

Module – IV

Back tracking, N-Queens problem, Graph Coloring, Branch and Bound, 15-Puzzle problem, NP – Completeness (Polynomial time, Polynomial time verification, NP - Completeness and reducibility, NP-

Complete problems (without Proofs)

Text Book:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest, C.Stein : Introduction to Algorithms, 2nd Edition, PHI Learning Pvt.Ltd.

2.Horowitz &Sahani: Fundamentals of Algorithm, 2nd Edition, Universities PressEducation.

Reference Books:

1. Sanjay Dasgupta, UmeshVazirani: Algorithms, McGraw-Hill Education.

2.H. Bhasin: Algorithms, Design and Analysis, First Edition, Oxford Higher

3. Goodrich, Tamassia: Algorithm Design, Wiley India.

Algorithm Design & Analysis Lab

1. Using a stack of characters, convert an infix string to postfix string.(1class)
2. Implement insertion, deletion, searching of a BST. (1class)
3. (a) Implement binary search and linear search in aprogram
   (b) Implement a heap sort using a maxheap.
4. (a) Implement DFS/ BFS for a connectedgraph.
   (b) Implement Dijkstra's shortest path algorithm usingBFS.
5. (a) Write a program to implement Huffman'salgorithm.
   (b) Implement MST using Kruskal/Primalgorithm.
6. (a) Write a program on Quick sortalgorithm.
   (b) Write a program on merge sortalgorithm.
   Take different input instances for both the algorithm and show the running time.
7. Implement Strassen's matrix multiplicationalgorithm.
8. Write down a program to find out a solution for 0 / 1 Knapsackproblem.
9. Using dynamic programming implementLCS.
10. Find out the solution to the N-Queenproblem.

Computer Architecture & Organization

Module 1

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs. **Data representation**: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carryadder, carry look-ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating pointarithmetic.

Module 2:

Introduction to Von-Neumann architecture. **CPU control unit design**: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU, Introduction to parallel processors. **Memory system design**: semiconductor memory technologies, memory organization, cache coherence. **Peripheral devices and their characteristics**: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI,USB

Module 3:

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, writepolicies.

Text books:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy,Elsevier.
2. " Computer Organization andArchitecture"by Carl Hamacher, Zaky McGraw Hill HigherEducation.

Reference books:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. " Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, PearsonEducation.
3. " Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F.Jordan, PearsonEducation.
4. Kai Hwang and Faye A Briggs, "Computer Architecture Parallel Processing", McGraw Hill,1985.

COMPUTER ORGANIZATION LAB

1. To recognize various components of PC.
2. Dismantling and assembling aPC.
3. Some experiments using Hardware trainer kits for SMPS, CPU , Hard disk , Motherboard, printer, real time clocketc.
4. Simulation of simple fundamental units like half adder, full adder, multiplexer, de-multiplexer, Arithmetic logic Unit, Simple processor (CPU) etc using VHDLcode.

OPERATING SYSTEMS

MODULE-I (10 Hours)

Overview Operating System, Simple Batch Processing Systems, Multiprogramming and Time Sharing systems. Personal Computer Systems, Parallel Systems, Distributed Systems and Real- time Systems. Operating System Structures: Operating System Services, System components, Protection system,

Operating System Services, system calls, Process Concept, Process Scheduling, Operation on Processes, Inter-process communication, Examples of IPC Systems, Multithreading Models, Threading Issues, Process Scheduling Basic concepts, scheduling criteria, scheduling algorithms, Thread Scheduling.

MODULE-II (10 Hours)

Process Coordination, Synchronization, Critical section problem, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors. Deadlocks, System model, Deadlock Characterization, Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock. Memory Management strategies, Logical versus Physical Address space, swapping, contiguous Allocation, Paging, Segmentation. Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, Page Replacement Algorithms. Allocation of frames, Thrashing, Demand Segmentation.

MODULE-III (10 Hours)

Recovery, Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, I/O System Overview, I/OHardware.

File system, file structure, Directory Structure, Allocation Methods, Basic concepts of Linux system, administration requirements, VM ware and Hypervisorconcepts.

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Concepts, 8th edition, Wiley-India, 2009.
2. NareshChouhan: Principles of Operating System, Oxford University Press.
3. Dhamdhare: Operating Systems: A Concept, 3rd Edition, Tata McGraw Hill Education India

REFERENCE BOOK:

1. William Stallings: Operating Systems, PHI Learning Pvt.Ltd.
2. H.M. Deitel, P. J. Deitel, D. R. Choffnes: Operating Systems, 3rdEdition, PearsonEducation.
3. Andrew S. Tanenbaum: Mordern Operating Systems, 3rdEdition, PHI Learning Pvt.Ltd.

OPERATING SYSTEM LABORATORY

1. Basic UNIXCommands.
2. Linux Administrative commands.
3. UNIX ShellProgramming.
4. Programs on process creation and synchronization, inter process communication including shared memory, pipes and messages.(Dinning Philosopher problem / Cigarette Smoker problem / Sleeping barberproblem)
5. Programs on UNIX Systemcalls.
6. Simulation of CPU Scheduling Algorithms. (FCFS, RR, SJF, Priority, MultilevelQueuing)
7. Simulation of Banker's Algorithm for Deadlock Avoidance,Prevention

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8. Program for FIFO, LRU, and OPTIMAL page replacementalgorithm.

9. Android Programming for mobileapplication.

FORMAL LANGUAGES AND AUTOMATA THEORY

Module-1 :

Fundamentals : Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and non deterministic finite automaton, transition diagrams and Languagerecognizers.

Finite Automata :NFA with ε transitions - Significance, acceptance of languages. Conversions and Equivalence : Equivalence between NFA with and without ε transitions, NFA to DFA conversion, minimization of FSM, equivalence between two FSM's, Moore and Melaymachines.

Module-2 :

Regular Languages : Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Pumping lemma of regular sets, closure properties of regular sets .

Grammar Formalism : Regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion, Context free grammar, derivation trees, sentential forms. Right most and leftmost derivation of strings.

Context Free Grammars : Ambiguity in context free grammars. Chomsky normal form, Greibach normal form, Pumping Lemma for Context Free Languages. Properties of CFL.

Push Down Automata : Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL andPDA.

Module-3:

Turing Machine : Turing Machine, definition, model, design of TM, Computable functions, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines , linear bounded automata and context sensitive language.

Computability Theory : Chomsky hierarchy of languages, undecidability problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems.

TEXT BOOKS :

1."Introduction to Automata Theory Languages and Computation". Hopcroft H.E. andUllman J. D. Pearson Education

2. Introduction to Theory of Computation – Sipser 2nd editionThomson

REFERENCES BOOKS:

1. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan Rama R.

2. Introduction to Computer Theory, Daniel I.A. Cohen, JohnWiley.

3. Theory of Computer Science – Automata languages and computation -Mishra and Chandrashekaran, 2nd edition,PHI.

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Engineering Economics (3-0-0)

Prerequisites:

1. Mathematics.
2. BasicEconomics.

Module 1: (10 Hours)

Engineering Economics: Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics.
Demand: Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Demand Estimation and Forecasting, Elasticity of demand & its measurement (Simple numerical problems to be solved), Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).
Production: Production function, Laws of returns: Law of variable proportion, Law of returns to scale.

Module 2: (10 Hours)

Cost and revenue concepts, Basic understanding of different market structures, Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), Break Even Analysis-linear approach (Simple numerical problems to be solved).
Banking: Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.
Inflation: Meaning of inflation, types, causes, measures to control inflation.
National Income: Definition, Concepts of national income, Method of measuring national income.

Module 3: (10 Hours)

Time value of money: Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.
Evaluation of engineering projects: Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for publicprojects.
Depreciation: Depreciation of capital assert, causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method), After tax comparison of project.

Text Books:

1. Riggs, Bedworth and Randhwa," Engineering Economics", McGraw Hill EducationIndia.
2. DevigaVengedasalam," Principles of Economics", Oxford UniversityPress.
3. William G. Sullivan, Elin M. Wicks, C. PatricKoelling," Engineering Economy",Pearson.
4. R. Paneer Selvam," Engineering Economics",PHI.
5. S. P. Gupta," Macro Economics",TMH.
6. S. B. Gupta," Monetary Economics", Sultan Chand andCo.

SYLLABUS FOR COMPUTER SCIENCE & ENGINEERING
B.TECH (AUTONOMOUS)
DURATION: 4 YEARS (EIGHT SEMESTERS)

Organizational Behaviour (3-0-0)

Prerequisites:
1. English.

Module 1: (10 Hours)
The study of Organizational Behaviour: Definition, Meaning, Why study OB; Learning - Principles of learning and learning theories; Personality- Meaning, Determinants, Types, Personality and OB; Perception- Perceptual Process, perceptual errors, Importance of perception in organizations; Motivation-Nature and Importance, Theories of motivation (Herzberg, Maslow, McGregor).

Module 2: (10 Hours)
Group level: Groups in Organizations -Nature, Types, Reasons behind forming groups, Determinants, factors contributing to Group Cohesiveness, Group Decision Making- Process, advantages and disadvantages; Team- Effective Team Building; Types of Leadership- Effective Leadership, Styles of leadership, Leadership Theories- Trait Theory and Contingency Theory, Leadership and Followership; Conflict- Healthy Vs Unhealthy conflict, Conflict Resolution Techniques.

Module 3: (10 Hours)
Structural level: Organizational Culture: culture and organizational effective- ness; Organizational Change: Types of change, Reasons to change, Resistance to change and to manage resistance. Introduction to organizational development.

Text Books:
1. Stephens P. Robbins, Organizational Behaviour, PHI.
2. K. Aswatthappa, Organizational Behaviour,HPH.

Reference Books:
1. Kavita Singh, Organizational Behaviour, Pearson.
2. D. K. Bhattacharya, Organizational Behaviour, OUP.
3. Pradeep Khandelwal, Organizational Behaviour,TMH.
4. Keith Davis, Organizational Behaviour, McGraw Hill.
5. Nelson Quick, ORGB, CengageLearning.

Environmental Science

4th Sem

Course Objectives:

- Understanding the importance of ecological balance for sustainabledevelopment.
- Understanding the impacts of developmental activities and mitigationmeasures
- Understanding the environmental policies andregulations

Course Outcomes:

Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn help in sustainable development

UNIT – I

An Introduction to – Multidisciplinary nature of Environmental Studies.

The Earth and Biosphere (The Earth Science)

Ecology: Concept and Principle of Ecology, Ecological Succession, Population Ecology, Community Ecology,

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Relationship, Human Ecology, Origin and Evolution of Life, Plant and Speciation.

Ecosystems: Definition, Properties, Function and Structure of Ecosystem. Ecological Balance: Cause, Food chains, food webs, Flow of Energy, Ecological Pyramids, Types of Ecosystem: Land, Aquatic and Artificial ecosystem. Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, Degradation of Ecosystem.

Bio-diversity and Conservation

Natural Resources: Classification of Resources, Conservation of Resources, Environmental Degradation, Equitable use of Resources for Sustainable Life styles, Role of Individual in Conservation of natural Resources.

Water Resources: Sources, Status of World and Indian's Water Resources, Over Utilization of Water, Conservation, Flood and Control measure, Others.

Mineral Resources. Land Resources, Energy Resources, Food Resources, etc.: Classification, Conservation, Environmental Impacts.

UNIT – II

Environmental Pollution: Types of Pollution and Control Measures, Role of Individual in Pollution Prevention.

Waste Management: MSW, WM Techniques, Agricultural Solid Waste Management and Legislation on Solid Waste management.

Disaster Management: Objectives, TypeofDisaster. Elements, Organisational Set- up, NDMA, Preparedness, Mitigation, Prevention,Response.

Environment and Development: Social Issues, environmental Ethics, Sustainable Development, Sustainable Energy and materials, Environmental Challenges,: Climate Change, Green House Effect, Global Warming, Ozone Layer Depletion, Protection of Ozone Layer, Acid Rain, EL Nino, Waste land and its Reclamation

Human Population and the Environment: Pupation Growth and Explosion, Pupation Growth and Environment, Family Welfare Programme, Women and Child welfare, HIV/ AIDS, Environment and Health, Human Rights, Value of Education.

Resettlement and Rehabilitation: Introduction, Social Impact Assessment, Methodology of SIA, Land Acquisition and Impact, Stake holder participation and consultation, Socio-economic Issue,, Mitigation Measure.

Rehabilitation Action Plan, Legal Frame work, Training and capacity Building, Grievance and Redressal Mechanism.

UNIT - III

Environmental Protection: Introduction, International efforts, Government Effort, environmental Organisations, Public Awareness, Environmental Education and Training, Green Building, Clean Development Mechanism, carbon Credits.

Environmental Legislation: Environmental Legal Framework, environmental Protection Act, 1986, the Air Act1981, Water Act 1974, Wild Life Act, 1972, Forest Conservation Act,1980.

Environmental Management: Environmental Impact Assessment, TOR for EIA, EIA Methodology (Brief), Baseline Data, Environmental Clearance, MoEF Notification Dated September 2006, Stake holder in EIA Process

Environment Management and EMP: Introduction, Issues covered, Environmental Management System- ISO-14000, Institution and Implementation Arrangement, Mitigation measures, Environmental Monitoring, Environmental Auditing.

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TEXT BOOKS:

1. Environmental Studies(Concept, Impacts, Mitigation and management) by M. P. Poonia and S. C. Sharama, Khana Book Publishing Co. (P) T Ltd. 2019Edition
2. Textbook of Environmental Studies for Undergraduate Courses by ErachBharucha for University GrantsCommission.
3. Environmental Studies by R. Rajagopalan, Oxford UniversityPress.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt.Ltd.
3. Environmental Science by Daniel B. Botkin& Edward A. Keller, Wiley INDIAedition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age internationalpublishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BSPublications.

DIGITAL SYSTEM DESIGN

Prerequisites: Basic concepts of number system, Basic knowledge of electronic circuits

Course Outcomes:

At the end of the course, a student will be able to:

1. Convert different type of codes and number systems which are used in digital communication and Computer systems and Employ the codes and number systems converting circuits and Compare different types of logicfamilies.
2. Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematicalmethods.
3. Design different types of digital electronic circuits (with and without memory element) for particular operation, within the realm of economic, performance, efficiency, user friendly and environmentalconstraints.
4. Design & analyze synchronous sequential logiccircuits
5. Use HDL & appropriate EDA tools for digital logic design andsimulation

Module I (13 Hrs)

Introduction to Digital Circuits: Representation of numbers in binary, octal, decimal and hexadecimal systems. Conversion between systems, 1's and 2's complement representation of numbers, binary multiplication and division.

Logic Gates and Combinational Circuits: Functions, representations and truth tables of logic gates. Universal logic gates, Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and DeMorgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 4 variables, Binary codes and different types of Code Conversions. Error correcting and detecting code.

MSI devices like Half Adder, Full Adder, Half Subtractor, Full Subtractor, Serial and Parallel Adders, BCD Adder, Comparators, Multiplexers, Demultiplexers, different types of MUX designing circuits, Encoder, Decoder.

Module II (12 Hrs)

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Algorithmic State Machines charts.

Module III (10 Hrs)

Introduction to Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements.

Textbook(s):

1. Morris Mano and Michael D. Ciletti, "Digital Design", 4th Ed., Pearson Education,2008.
2. C.H. Roth, "Fundamentals of Logic Design", 5th Ed. Cengage Learning,2004.
3. John F. Wakerly, "Digital Design: Principles & Practices", 3rd Ed,PHI.
4. A Anand Kumar, "Fundamentals of Digital Circuits", 2nd Ed.,PHI.

Reference Book(s):

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition,2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition,2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, 2006.
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill,1989

SYLLABUS FOR COMPUTER SCIENCE & ENGINEERING
B.TECH (AUTONOMOUS)
DURATION: 4 YEARS (EIGHT SEMESTERS)

DETAILED 4-YEAR CURRICULUMCONTENTS

Undergraduate Degree in Engineering &Technology

Branch/Course: COMPUTER SCIENCE AND ENGINEERING

Year-3rd

(5th& 6thSemester)

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DATABASE MANAGEMENT SYSTEMS

Module I: (07 Hours)
Introduction to database Systems, advantages of database system over traditional file system, Basic concepts & Definitions, Database users, Database Language, Database System Architecture, Schemas, Sub Schemas, & Instances, database constraints, 3-level database architecture, Data Abstraction, Data Independence, Mappings, Structure, Components & functions of DBMS, Data models.

Module II: (08 Hours)
Entity relationship model, Components of ER model, Mapping E-R model to Relational schema, Network and Object Oriented Data models. Relational Algebra, Tuple & Domain Relational Calculus, Relational Query Languages: SQL and QBE. Query processing and optimization: Evaluation of Relational Algebra Expressions, Query optimization, Query cost estimation.

Module III: (07 Hours)
Database Design:-Database development life cycle (DDLC), Automated design tools, Functional dependency and Decomposition, Join strategies, Dependency Preservation & lossless Design, Normalization, Normal forms:1NF, 2NF,3NF, and BCNF, Multi-valued Dependencies, 4NF & 5NF.

Module IV: (08 Hours)
Transaction processing and concurrency control: Transaction concepts, properties of transaction, concurrency control, locking and Timestamp methods for concurrency control schemes. Database Recovery System, Types of Data Base failure & Types of Database Recovery, Recovery techniques. Fundamental concepts of advanceddatabases.
Storage Strategies: Detailed Storage Architecture, RAID

Text Books:
1. Sudarshan, Korth: Database System Concepts, 6th edition, McGraw-HillEducation.

References Books:
1. Elmasari&Navathe: Fundamentals of Database System, PearsonEducation.
2. Ramakrishnan: Database Management Systems, McGraw-HillEducation.
3. Andrew S. Tanenbaum: Modern Operating Systems, 3rd Edition, PearsonEducation.
4. 0Terry Dawson, Olaf Kirch: Linux Network Administrator's Guide, 3rd Edition, O'ReillyMedia

DATABASE MANAGEMENT SYSTEM LAB

1. Use of SQL syntax: insertion, deletion, join, updation using SQL. (1class)
2. Programs on join statements and SQL queries including where clause. (1class)
3. Programs on procedures and functions. (1 class)

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4. Programs on database triggers. (1 class)
5. Programs on packages. (1class)
6. Programs on data recovery using check point technique. (1class)
7. Concurrency control problem using lock operations. (1class)
8. Programs on ODBC using either VB or VC++. (1class)
9. Programs on JDBC. (1class)
10. Programs on embedded SQL using C / C++ as host language. (1class)

COMPUTER NETWORKS

Module – I (07 Hrs)

Overview of Data Communication Networks, Protocols and standards, OSI Reference model, TCP/IP Protocol. Physical Layer: Analog Signals, Digital Signals, Data Rate Limits, Transmission Impairment, Data rate limit, Digital Transmission: Digital-to-Digital conversion, Analog-to-Digital conversion, Transmission modes, Analog Transmission: Digital-to-Analog conversion, Analog-to-Analog conversion, Multiplexing: Frequency Division Multiplexing (FDM), Wave Division Multiplexing (WDM), Time Division Multiplexing (TDM), Transmission Media: Guided Media (Twisted-Pair Cable, Coaxial Cable and Fiber-Optic Cable) and unguided media (wireless).

Module – II (08 Hrs)

Error Detection and correction: Types of Errors, Error Detection mechanism (Linear codes, CRC, Checksum), Error Correction mechanism: Hamming Encoding. Data Link Control and Protocols: Flow and Error Control, Stop-and-Wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC and Point-to-Point Protocol, Multiple Access: Random Access (ALOHA, CSMA, CSMA/CD, CSMA/CA), Controlled Access (Polling, Reservation, Token Passing), Channelization (FDMA, TDMA, CDMA). Wired LANs (Ethernet): Traditional Ethernet, Fast Ethernet, GigabitEthernet.

Module – III (08 Hrs)

Wireless LANs: IEEE 802.11 and Bluetooth.

Network Layer: IPV4 addresses, IPV6 addresses, Internet Protocol: Internetworking, IPV4 datagram, IPV6 packet format and advantages. Network Layer Protocols: ARP, RARP, IGMP and ICMP. Routing: Unicast Routing Protocols and Multicast RoutingProtocols.

Transport Layer: Process to Process Delivery, User Datagram Protocol (UDP) and Transmission Control Protocol (TCP).

Module – IV (07Hrs)

Domain Name System (DNS): Name Space, Domain Name Space, DNS in Internet, Resolution and Dynamic Domain Name System (DDNS), Remote logging, Electronic Mail

(SMTP) and file transfer (FTP), WWW: Architecture & Web document, HTTP: Transaction & Persistent vs. Non-persistent connection.

Text Books:

1. Computer Networks, A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint ofPearson.
2. Data and Computer Communications, William Stallings, Prentice Hall, Imprint of Pearson.

Reference Books:

1. Data Communication and Networks, Bhushan Trivedi, Oxford UniversityPress
2. Computer Networks A system Approach, Larry L, Peterson and Bruce S. Davie,Elsevier.
3. Computer Networks, Natalia Olifer, Victor Olifer, WilleyIndia.

COMPUTER NETWORK LAB

1. Some Network protocol simulation using NetSim, NS2, etc.for

i) Analyzing number of transmitting nodes vs. collision count, mean delay for EthernetLAN

ii) Analyzing bus vs. star-switch with respect to number of collisions (for a fixed number of transmitting nodes) for EthernetLAN

iii) Analyzing performance of token ring with number of nodes vs. response time, mean delay usingNetSim.

iv) Comparing the throughput and normalized throughput for token ring and token bus for different transmittingnodes.

v) Comparing the CSMA/CD vs. CSMA/CA protocols (for a fixed number of transmitting nodes).

vi) Analyzing the difference between unicast and broadcast transmission (for a fixed number of transmittingnodes).

vii) Verification of stop-and-waitprotocol.

viii) Verification of Go-back-Nprotocol.

ix) Verification of Selective repeatprotocol.

x) Verification of distance vector routingalgorithm.

xi) Verification of link state routingalgorithm.

2. Some programming techniques in socketprogramming.

INTERNET & WEB TECHNOLOGY

Module-1:

Introduction, Evolution of Internet, WEB 2.0 and Evolution of WWW, Internet Protocol-

TCP/IP: addressing and routing, UDP, HTTP, Secure http (https) Domain name server and IP Addresses, Web Server, Web Browser, Two-tier and three-tier web based architectures, FTP, Email.

Module-2:
HTML-Introduction, Basic HTML tags, images, links, Lists, Tables, forms, Frames, Introduction to HTML5. CSS-Syntax, Class Selector, ID selector, External & Internal style sheets, Inline style & class selector, div and span, Change the properties like background images, colors, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS. Introduction to CSS3,XML

Module-3:
PHP-Starting to script on server side, arrays, function and forms, Advance PHP- File upload, Cookies, Sessions, Filters, Error Handling, Exception. Databases-Basic Commands with PHP examples, Connection to server, creating a database, selecting a database, listing database, listing table names, insertion, deletion, update in a table, PHP myadmin and database bugs.
Security-threats, types of viruses, firewall

Reference Books

1. Web Programming: Building Internet Applications, Chris Bates, WileyDreamtech
2. Programming the World Wide Web, Robert W Sebesta,Pearson
3. Web Technologies, Uttam K Roy,Oxford
4. Web Technology: A developer perspective, Gopalan&Akilandeswari,PHI
5. Web Warrior Guide to Web Design Technologies, Don Gosselin, Joel Sklar& others, Cengage Learning
6. Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites – by Robin Nixon,Oreilly
7. PHP & MySQL: The Missing Manual – by Brett McLaughlin,Oreilly

INTERNET & WEB TECHNOLOGY LAB

1. HTML basic text formattingtags
2. HTML tables,lists
3. HTML frames,links
4. CSS programming, CSS stylesheets
5. Javascript, event handlingprograms
6. PHP basiccommands

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7. PHP arrays andfunctions
8. PHP databaseconnectivity
9. Insert, update and delete on a database usingPHP
10. Solving databasebugs

ARTIFICIAL INTELLIGENCE

Module-1

Introduction to AI and intelligent agents. Problem Solving: Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods. Game Playing: minimax, alpha-beta pruning.

Module-2

Knowledge and Reasoning: Building a Knowledge Base: Propositional logic, first order Logic, situation calculus. Theorem Proving in First Order Logic, Planning, partial order planning.

Module-3

Uncertain Knowledge and Reasoning, Probabilities, Bayesian Networks. Learning: Overview of different forms of learning, Learning Decision Trees, Neural Networks, Introduction to Natural Language Processing.

Text Books:

1. Stuart Russell and Peter Norvic, Artificial Intelligence: A Modern Approach,Prentice-Hall.
2. Nils J. Nilsson, Artificial Intelligence: A New Synthesis,Morgan-Kaufmann.
3. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall of India, Delhi, 2001.

Reference Books:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence" Tata McGraw Hill, Delhi,2001.
2. George F Luger, "Artificial Intelligence, structures and strategies for complex problem solving", Pearson Education Delhi,2001.

ADVANCED COMPUTER ARCHITECTURE

Module – I (07 Hrs)

Introduction to Computer Architecture : Microprocessor and Microcontroller, RISC and CISC architectures, Parallelism, Pipelining fundamentals, Arithmetic and Instruction pipelining, Pipeline Hazards, Superscalar Architecture, Super Pipelined Architecture.

Module – II (08 Hrs)

Basic Multiprocessor Architecture: Flynn's Classification, Distributed Memory Architecture : UMA, NUMA, NORMA, COMA, Array Processor, Vector Processors. ILP concepts: Pipelining overview, Dynamic Branch Prediction, Dynamic Scheduling, Multiple Instruction Issue, Static

scheduling, Multi-threading, VLIW Architecture, Limitations of ILP.

Module – III (07 Hrs)

Interconnection Networks: Static Networks, Network Topologies, Dynamic Networks, Cloud Computing, Cluster Computer.

Module –IV (08 Hrs)

Memory Technology: Cache, Cache updating schemes, Virtual memory, Page replacement techniques, I/O subsystems.

Text Book

1. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability,Programmability, McGraw-Hill.
2. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGrawHill.

References:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, MorganKaufmann.
2. Computer Organization: Carl Hamacher, Zvonkovranesic, SafwatZaky, McGrawHill
3. Computer Architecture: Parhami, Oxford UniversityPress
4. DezsoSima, Terence Fountain, and Peter Kacsuk, Advanced Computer Architecture:A Design Space Approach, Addison Wesley.
5. John Paul Shen and MikkoLipasti, Modern Processor Design, Tata McGrawHill

SYSTEM PROGRAMMING

Module I (10 Hrs)

Introduction: System Software, Application Software, Overview on Components of a programming system: Assembler, Loader, Linker, Macros, Compiler, Interpreter, Debugger, Evolution of Operating Systems, Functions of Operating System, Tools, Life Cycle of a Source Program, Different Views on the Meaning of a Program, System Software Development, Machine Structure: General Machine Structure, Approach to a new machine, Memory Registers, Data, Instructions, Evolution of Machine Language: Long Way: No looping, Looping,

Module II (10 Hrs)

Introduction to Assembly Language Program. Assemblers: Assembler Design Criteria, Types of Assembler, Design of Assembler, Two-pass Assembler,

Macros Language and Macro Processor: Macro Definition and Call, Macro Expansion, Nested Macro calls, Advanced Macro Facilities, Features of a Macro Facility, Implementation.

Loaders: Loader Schemes, Design of a General Loader Scheme, Absolute Loader, Direct Linking loader, Compile and Go Loader, Bootstrap Loader. Dynamic Loading and Linking, Algorithm and Data structures for Linking Loader, Linkers and LinkageEditors.

Module III (10 Hrs)

Programming Languages: Importance of High Level Languages, Features, Data Types and Data Structures, Storage Allocation and Scope Name, Accessing Flexibility, Functional Modularity. Introduction to Compilers, passes of compiler, Phases of a compiler.

Text Book:

1. Systems Programming by John J Donovan (McGraw-Hill Education)

Reference Books:

1. Operating System and System Programming – Dhamdhere (McGraw-HillEducation)
2. System Programming,bySrimanta Pal, Oxford UniversityPress
3. System Software, S. Chattopadhyay (Prentice-Hall India)
4. System Programming with C and UNIX. - Hoover (PearsonEducation)

IMAGE PROCESSING

Module-1:

Digital Image Fundamentals: A simple image model, Sampling and Quantization, Imaging Geometry, Digital Geometry, Image Acquisition Systems, Different types of digital images.

Bilevel Image Processing: Basic concepts of digital distances, distance transform, medial axis transform, component labeling, thinning, morphological processing, extension to grey scale morphology.

Module-2:

Binarization and Segmentation of Grey level images: Histogram of grey level images, Optimal thresholding using Bayesian classification, multilevel thresholding, Segmentation of grey level images, Water shade algorithm for segmenting grey level image.

Detection of edges and lines in 2D images: First order and second order edge operators, multi-scale edge detection, Canny's edge detection algorithm, Hough transform for detecting lines and curves, edge linking.

Module-3:

Images Enhancement: Point processing, Spatial Filtering, Frequency domain filtering, multi-spectral image enhancement, image restoration.

Color Image Processing: Color Representation, Laws of color matching, chromaticity diagram, color enhancement, color image segmentation, color edge detection, color demosaicing.

Image Registration and depth estimation: Registration Algorithms, Setreo Imaging, Computation of disparity map.

Image compression: Lossy and lossless compression schemes, prediction based compression schemes, vector quantization, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme.

Text Books:

1. Gonzalez and Woods, Digital Image Processing,Prentice-Hall.
2. Anil K.Jain – Fundamentals of digital image processing – Prentice Hall information and System Science series,1989.

Reference Books:

1. Pratt W.K., Digital Image Processing, 2nd Edition, John Wiley & Sons,1991.
2. Rosenfied A. and Kak, A.C. Digital picture processing, Vol. I & II, academic press 1982.
3. Nick Efford – Digital Image Processing a practical introduction using Java – Addison Wesley / Benjamin Cummings,2000.

COMPILER DESIGN

Module-1

Overview of the Translation Process: A Simple Compiler, Difference between interpreter, assembler and compiler. Overview and use of linker and loader, types of Compiler, Analysis of the Source Program, The Phases of a Compiler.
Lexical Analyzer: Introduction to Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, A Language for Specifying Lexical Analyzers, Finite Automata From a Regular Expression, Design of a Lexical Analyzer Generator.

Module-2

Parsing : Top Down and Bottom up Parsing Algorithms, Top-Down Parsing, Bottom-Up Parsing, Operator-Precedence Parsing, LR Parsers, Using Ambiguous Grammars, Parser Generators, Automatic Generation ofParsers.
Semantic Analysis: Syntax Directed Translation Mechanisms And Attributed Mechanisms And Attributed Definition, Syntax-Directed Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed Definitions, L-Attributed Definitions, syntax-directed definitions and translation schemes. Intermediate Code Generation : Different Intermediate Forms.

Module-3

Code Generation: Issues in the Design of a Code Generator, The Target Machine, Run-Time Storage Management, Basic Blocks and Flow Graphs, Register Allocation and Assignment, The DAG Representation of Basic Blocks, Peephole Optimization, Generating Code from DAGs, Dynamic Programming Code-Generation Algorithm, Code Generator. Code Optimization: Global Data Flow Analysis, A Few Selected Optimizations like Common Sub Expression Removal, Loop Invariant Code Motion, Strength Reductionetc.

Text Books:

1. Compilers: Principles, Techniques and Tools ByAho, Lam, Sethi, and Ullman, Second Edition, Pearson,2014

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2. Compiler Design in C By Allen I. Holub,Prentice-Hall/Pearson.
3. Advanced Compiler Design and Implementation ByMuchnick, Morgan and Kaufmann,1998.
4. D.M.Dhamdhere, "Systems Programming and Operating Systems", Tata McGraw Hill Company, Delhi,2002.

Compiler Design Lab

1 & 2 implement a lexical analyzer in "C".

3. Use LEX tool to implement a lexicalanalyzer.

4. Implement a recursive descent parser for an expression grammar that generates arithmetic expressions with digits, + and*.

5. Use YACC and LEX to implement a parser for the same grammar as given inproblem

6. Write semantic rules to the YACC program in problem 5 and implement a calculator that takes an expression with digits, + and * and computes and prints itsvalue.

7 & 8. Implement the front end of a compiler that generates the three address code for a simple language with: one data type integer, arithmetic operators, relational operators, variable declaration statement, one conditional construct, one iterative construct and assignment statement.

3. 9 &10. Implement the back end of the compiler which takes the three address code generated in problems 7 and 8, and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler. The target assembly instructions can be simple move, add, sub, and jump. Also simple addressing modes areused.

SOFTWARE ENGINEERING

MODULE I: (10hours)

Software Process Models: Software Product, Software crisis, Handling complexity through Abstraction and Decomposition, Overview of software development activities, Process Models, Classical waterfall model, iterative waterfall model, prototyping mode, evolutionary model, spiral model, RAD model, V Model, Agile models: Extreme Programming, and Scrum. **Software Requirements Engineering:** Requirement Gathering and Analysis, Functional and Non-functional requirements, Software Requirement Specification (SRS), IEEE 830 guidelines, Decision tables andtrees.

MODULE II: (10 hours)

Structured Analysis & Design: Overview of design process: High-level and detailed design, Cohesion and coupling, Modularity and layering, Function–Oriented software design: Structured Analysis using DFD Structured Design using Structure Chart, Basic concepts of Object Oriented Analysis & Design. User interface design, Command language, menu and iconic interfaces, UML. **Coding and Software Testing Techniques:** Coding, Code Review, documentation. Testing: - Unit testing, Black-box Testing, Whitebox testing, Cyclomatic complexity measure, coverage analysis, mutation testing, Debugging techniques, Integration testing, System testing, Regression testing.

MODULE III: (10 hours)
Software Reliability and Software Maintenance: Basic concepts in software reliability, reliability measures, reliability growth modelling, Quality SEI CMM, Characteristics of software maintenance, software reverse engineering, software reengineering, software reuse. **Emerging Topics:** Client-Server Software Engineering, Service-oriented Architecture (SOA), Software as a Service (SaaS).

Text Book:
1. Software Engineering, A Practitioner's Approach, Roger S. Pressman, TMGHill.
2. Software Engineering, I. Sommerville, 9th Ed. , PearsonEducation.

Reference Books:
1. Fundamentals of Software Engineering, Rajib Mall, PHI,2014.
2. Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa Publishing House, Delhi,2000.

SOFTWARE ENGINEERING LABORATORY

Experiment1: Develop requirements specification for a given problem (The requirements specification should include both functional and non-functional requirements. For a set of about 20 sample problems, see the questions section of Chap 6 of Software Engineering book of Rajib Mall)
Experiment 2: Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required)
Experiment 3: Develop structured design for the DFD model developed
Experiment 4: Develop UML Use case model for a problem (Use of a CASE tool any of Rational rose, Argo UML, or Visual Paradigm etc. is required)
Experiment 5: Develop Sequence Diagrams.
Experiment 6: Develop Class diagrams.
Experiment 7: Develop code for the developed class model using Java.
Experiment 8: Use testing tool such as Junit.
Experiment 9: Use a configuration management tool.
Experiment 10: Use any one project management tool such as Microsoft Project or Gantt

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Project, etc.

SIGNALS AND SYSTEMS

Prerequisite: Basic knowledge of Engineering Mathematics required, which includes - Differential equations and Integrals, Laplace transform, Ordinary differentialequations, Complex numbers, Series and expansions, Fourier analysis.

Course outcomes:

At the end of this course students will be able to

1. Analyze different types ofsignals
2. Represent continuous and discrete systems in time and frequency domain usingdifferent transforms
3. Investigate whether the system isstable
4. Sampling and reconstruction of asignal

Module I (10Hrs)

An introduction to signals and systems: Signals and systems as seen in everyday life, and in various branches of engineering, Continuous-Time and Discrete-Time Signals, Transformations of the Independent Variable, Exponential and Sinusoidal Signals, The Unit Impulse and Unit Step Functions, Continuous-Time and Discrete-Time Systems, Basic SystemProperties.

Linear Time-Invariant Systems: Continuous-Time LTI Systems: The Convolution Integral, Properties of Linear Time-Invariant Systems, Causal LTI Systems Described by Differential and Difference Equations, Singularity Functions. **Fourier analysis of Continuous Time signal and system:** A Historical Perspective, The Response of LTI Systems to Complex Exponentials, Fourier Series Representation of Continuous-Time Periodic Signals, Convergence of the Fourier Series, Properties of Continuous-Time Fourier Series, Fourier Series and LTI Systems, Filtering, Examples of Continuous-Time Filters Described by Differential Equations.

Module II (10Hrs)

The Continuous-Time Fourier Transform: Representation of Aperiodic Signals: The Continuous-Time Fourier Transform, The Fourier Transform for Periodic Signals, Properties of the Continuous-Time Fourier Transform, The Convolution Property, The Multiplication

Property, Fourier Properties and Basic Fourier Transform Pairs, Systems Characterized by Linear Constant-Coefficient Differential Equations. **Time- and Frequency Characterization of Signals and Systems:** The Magnitude-Phase Representation of the Fourier Transform, The Magnitude-Phase Representation of the Frequency Response of LTI Systems, Time-Domain Properties of Ideal Frequency-Selective Filters, Time- Domain and Frequency-Domain Aspects of Nonideal Filters, First-Order and Second-Order Continuous-Time Systems.

Module III (10 Hrs)

The Laplace Transform: The Laplace Transform for continuous time signals and systems: the notion of Eigen functions of LSI systems, a basis of Eigen functions, region of convergence, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. Generalization of Parseval's Theorem. **Sampling:** Representation of a Continuous-Time Signal by Its Samples: The Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation, The Effect of Undersampling: Aliasing, Discrete-Time Processing of Continuous-Time Signals.

Textbook(s):

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. A NagoorKani, Signals & Systems" 2ND edition,Mc-Graw Hill.2017
3. Schaum's outlines, Signal and System, H.P.Hsu, 2ndEdition

Reference book(s):

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, PrenticeHall.
2. Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition.
3. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited.
4. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", Tata Mc Graw HillEdition.

EMBEDDED SYSTEMS

Module I Hardware Concepts (10Hours)
Introduction: Features of Embedded systems, Design matrices, and Embedded system design flow, SOC and VLSI circuit. ARM: An advanced Micro Controller, Brief history, ARM pipeline, Instruction Set Architecture ISA: Registers, Data Processing Instructions, Data Transfer Instructions, Multiplications instructions, Software interrupt, Conditional execution, branch instruction, Swap instruction, THUMB instructions. FPGA

Module II (12 Hours)
Devices and device drivers, I/O devices, Serial peripheral interfaces, IIC, RS232C, RS422, RS485, Universal serial bus, USB Interface, USB Connector IrDA, CAN, Bluetooth, ISA, PCI, PCI – X and advance busses, Device drivers.

Real-Time Task Scheduling: Some important concepts, Types of real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix-based Real-time operating systems, POSIX-RT, A survey of contemporary Real-time operating systems, Microkernel-based systems.

Module – III (08 Hours)
Hardware and software partitioning: K-L partitioning, Partitioning using genetic algorithm, particle swarm optimization, Functional partitioning and optimization: functional partitioning, high level optimizations. Hardware software co-simulations

TEXTBOOKS
1. S. Chattopadhyay, Embedded System Design,PHI
2. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware /Software Introduction, JohnWiley
3. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First IndianReprint .

REFERENCES
1. Shibu KV, Introduction to Embedded Systems,TMH
2. Wayne Wolf, Computers as Components; Principles of Embedded Computing SystemDesign – Harcourt India, Morgan Kaufman Publishers.

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ADVANCED OPERATING SYSTEM

Module 1: (10 Hours)

Introduction to UNIX/Linux Kernel : System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System Concepts of Linux Programming, Getting Started with System Programming

Module 2: (10 Hours)

File and Directory I/O :inodes, structure of regular file, open, read, write, lseek, close, pipes, open, creat, close, fseek, read, write, file sharing, atomic operations, dup and dup2, fcntl, ioctl, /dev/fd, stat, fstat, fstat, file types,Set-User-ID and Set-Group-ID, file access permissions, ownership of new files and directories, access function, umaskfunction, chmod and fchmod, sticky bit, chown, fchown, and lchown, file size, file truncation, file systems, link, unlink, remove, and rename functions, symbolic links, symlink and readlink functions, file times, utime, mkdirandrmdir, readingdirectories, chdir, fchdir, and getcwd, device special, Scatter/Gather I/O, The Event Poll Interface, Mapping Files into Memory, Advice for Normal File I/O, Synchronized, Synchronous, and Asynchronous Operations, I/O Schedulers and I/O Performance, Files and their Metadata , Directories, Links, Copying and Moving files, Device Nodes, Out-of- Band Communication, Monitoring FileEvents

Module 3: (10 Hours)

Process Environment, Process Control and Process Relationships: Process states and transitions, the context of a process, saving the context of a process, sleep, process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, Process termination, environment list, memory layout of a C program, shared libraries, memory allocation, environment variables, setjmp and longjmp, getrlimit and setrlimit, process identifiers, fork, vfork, exit, wait and waitpid, waitid, wait3 andwait4, race conditions, exec, changing user IDs and group IDs, interpreter files, system function, process accounting, user identification, process times, Terminal logins, network logins, process groups, sessions, controlling terminal, tcgetpgrp, tcsetpgrp, and tcgetsid functions, job control, shell execution of programs, orphanedprocess, The Process ID, Running a New Process, Terminating a Process, Waiting for Terminated Child Processes, Users and Groups, Sessions and Process Groups, Daemons, Process Scheduling, Yielding the Processor, Process Priorities, ProcessorAffinity

Reference Books:

1. Linux System Programming, O'Reilly, by RobertLove.
2. Windows Internals, Microsoft Press, by Mark E. Russinovich and David A.Soloman.
3. The Design of the UNIX Operating System, PHI, by Maurice J.Bach.
5. Advanced Programming in the UNIX Environment, Addison-Wesley, byRichard Stevens

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6. Guide to Assembly Language Programming in Linux, Sivarama P. Dandamudi,Springer
7. Professional Assembly Language, Richard Blum, Wrox, WileyIndia

SOFT COMPUTING

Module-1:
Introduction to Soft Computing: Concept of computing systems, "Soft" compiting versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques Artificial Neural Networks, Biological neurons and its working, Simulation of biolgical neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real life problems. Back propagation neural networks, ADALINE and MADALINE, Radial Basis Function Network, Kohonen's Self Organizing Maps.

Module-2:
Fuzzy logic: Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Fuzzy logic controller design, Some applications of Fuzzy logic.

Module-3:
Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc., Solving single-objective optimization problems using GAs, Multi-objective Optimization Problem Solving, Concept of multi-objective optimization problems (MOOPs) and issues of solving them, Multi-Objective Evolutionary Algorithm (MOEA), Non-Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs, Some applications withMOEAs.

Reference Books:
1. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis &Applications,
2. S. Rajasekaran, G. A. Vijayalakshami,PHI.
3. Chin Teng Lin, C. S. George Lee, Neuro-Fuzzy Systems,PHI
4. TomthyRoss,Fuzzy Logic and Engineering Application,TMH
5. KishanMehrotra,Elements of Artificial Neural Network, MITPress
6. E. Goldberg,Genetic Algorithms: Search and Optimization,Addision-Wesley

SPEECH AND NATURAL LANGUAGE PROCESSING

Module-1:
Speech and Natural Language Processing: Introduction; Brief Review of Regular Expressions and Automata; Finite State Transducers; Word level Morphology and Computational Phonology;

Basic Text to Speech; Introduction to HMMs and Speech Recognition.

Module-2:

Indian language case studies; Part of Speech Tagging; Parsing with CFGs; Probabilistic Parsing. Representation of Meaning; Semantic Analysis; Lexical Semantics;

Module-3:

Word Sense; Disambiguation; Discourse understanding; Natural Language Generation; Techniques of Machine Translation; Indian Language case studies.

References

1. Daniel Jurafsky and James H. Martin, Speech and Language Processing,Prentice-Hall.
2. Chris Manning and HinrichSchuetze, Foundations of Statistical Natural Language Processing, MITPress.

DIGITAL SIGNAL PROCESSING

Prerequisites: Basic knowledge in Signals and systems, Fourier series and transform, differential equations

Course Outcomes:

On successful completion of the course, students will be able to,

1. Determine the spectral coefficients of discrete-timesignals.
2. Determine the frequency response and the z-transform representation of discrete-time systems.
3. Determine the discrete Fourier transform of discrete-timesignals.
4. calculate the outputs of discrete-time systems in response toinputs.
5. Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters, and evaluate the performance to meet expected system specifications usingMATLAB.
6. Demonstrate an understanding of contemporary issues by reviewing recent technical articles and establishing relationships between the course material and the content of the article.

Module I (10 Hrs)

Introduction to Digital Signal Processing: Discrete time complex exponentials and other basic signals, scaling of the independent axis and differences from its continuous, system properties (linearity, time invariance, memory, causality, BIBO stability), LTI systems described by linear

constant coefficient difference equations (LCCDE), auto correlation.

Discrete-Time Signals and Systems (Frequency Domain analysis): Linear convolution and its properties, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems. Frequency domain representation of Discrete-Time Signals & Systems, Representation of sequences by discrete time Fourier Transform, (DTFT), Properties of discrete Time Fourier Transform, and correlation of signals.

Module II (10 Hrs)

Z Transform: Generalized complex exponentials as eigen signals of LTI systems, z-transform definition, region of convergence (ROC)properties of ROC, properties of the z-transform,

inverse z-transform methods (partial fraction expansion, power series method, contour integral approach),pole, zero plots, time domain responses of simple pole, zero plots, ROC implications of causality and stability.

Discrete-Fourier Transform & Fast Fourier Transform: Representation of Periodic sequences: The discrete Fourier Series and its Properties Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT. FFT-Efficient Computation of DFT, Goertzel Algorithm, radix-2 Decimation-in-Time and Decimation -in-Frequency FFT Algorithms

Module III (10 Hrs)

Filter Design Techniques: Design of Discrete-Time IIR filters from Continuous-Time filters Approximation by derivatives, Impulse invariance and Bilinear Transformation methods; Design of FIRfilters.

Textbook(s):

1. Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schafer, 3rd edition, 2010, Prentice Hall, Upper Saddle River,NJ.
2. Digital Signal Processing by John G. Proakis and Dimitris K. Manolakis, 4th edition, 2007, Prentice Hall, Upper Saddle River,NJ.

3. Digital *Signal Processing* by SanjitMitra, 4th edition, 2011, McGraw-Hill, New York,NY.

Reference Book(s):

1. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co.
2. Digital Signal Processing, A. NagoorKani, TMH Education

DATA MINING

Module-1 [10 Hours]

Introduction to Data mining: - Role Data in Data Mining, Data Mining functionalities, patterns in data mining, Type of patterns, Classification of Data Mining Systems, Major issues in Data Mining. **Data Preprocessing:**-Why Preprocess the Data?, Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, **Data Warehousing and OLAP Technology for Data Mining:** -What Is a DataWarehouse? A Multidimensional Data Model, DataWarehouse Architecture, DataWarehouse Implementation, From DataWarehousing to Data Mining, OLAPtools.

Module-2 [10Hours]

Mining Association Rules in Large Databases : Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint- Based Association Mining.**Classification and Prediction:** Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Backpropagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, and ClassifierAccuracy.

Module-3[10 Hours]

Cluster Analysis Introduction : Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis. **Mining Complex Data:** Graph Mining, Social Network Analysis, Multirelational Data Mining, Spatial data minig, Multimedia data mining, Text data mining,Mining the World WideWeb
OLAP tools, Tools for Data warehousing, WEKA tool.

TEXT BOOK

1. Data Mining – Concepts and Techniques – Jiawei Han, MichelinenKamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition,2006.

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2. Pieter Adriaans, DolfZantinge, "Data Mining", Addison Wesley,1996.

Information Theory & Coding

Module1:
Information Theory:Entropy, its characterization and related properties, Huffman codes, Shannon-Fano coding, robustness of coding techniques, Information measure-noiseless coding, discrete memoryless channel – channel capacity, fundamental theorem of information theory.

Module2:
Coding Theory: *Error correcting codes:* minimum distance principles, Hamming bound, general binary code, group code, linear group code *Convolution encoding:* algebraic structure, Gilbert bound *Threshold decoding:* threshold decoding for block codes *Cyclic binary codes:* BCH codes, generalized BCH code and decoding, optimum codes, concepts of non-cycliccodes.

Module3:
Combinatorial Designs: Definitions of BIBD, Hadamard Designs, Latin Squares, Mutually Orthogonal Latin Squares, Orthogonal Arrays. Constructions of codes using designs: Example: Hadamard codes. Network Coding: Fundamentals of Network Coding: Butterfly networks, graphs and networks The max-flow min-cut theorem, the multi-source multicast problem, deterministic code design for network coding, randomized network coding application of networkcoding

Text Books:

1. J. A. Thomas and T. M. Cover: Elements of information theory, Wiley,2006.
2. J. H. van Lint: Introduction to Coding Theory, Third Edition, Springer,1998.
3. F. J. MacWilliams and N.J. Sloane: Theory of Error Correcting Codes, Parts I and II, North-Holland, Amsterdam,1977.
4. D. Stinson: Combinatorial Designs: Constructions and Analysis, Springer,2003

Reference Books:

1. P. J. Cameron and J. H. van Lint: Designs, Graphs, Codes and their Links, Cambridge University Press,2010.
2. C. Fragouli and E. Soljanin: Network Coding Fundamentals, Now Publisher,2007.
3. M. Medard and A. Sprintson, (editors): Network Coding – Fundamentals and Applications, Acadamic Press, 2012.

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DETAILED 4-YEAR CURRICULUM

CONTENTS Undergraduate Degree in

Engineering & Technology

Branch/Course: COMPUTER SCIENCE AND ENGINEERING

Year-4th

(7th& 8thSemester)

COMPUTATIONAL NUMBER THEORY

Module-1:

Modular Arithmetic: Solving Modular Linear Equations, the Chinese Remainder Theorem, Modular Exponentiation, and Discrete Logarithm Problem; GCD Computation: Euclid's Algorithm, Extended Euclid's Algorithm; Key Exchange: Diffie Hellman, ElGamal, Massey-Omura,

Module2:

Computation of Generators of Primes; Public Key Cryptosystem: RSA, Different Attacks & Remedies; Primality Testing: Pseudoprimality Testing, Quadratic Residues, Randomized Primality Test & Deterministic Polynomial Time Algorithm; Factorization: Quadratic-Sieve Factoring Algorithm, Pollard-Rho Method;

Module3:

Elliptic Curve Cryptosystem: Theory of Elliptic Curves, Elliptic Curve Encryption & Decryption Algorithms, Security of Elliptic Curves Cryptography, Elliptic Curve Factorization; Cryptographic Hash Functions: MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA-1), Security of Hash Functions & Birthday Attack; Digital Signatures: Authentication Protocols, Digital Signature Standards(DSS).

Text Books :

1.T. H. Cormen, C. E. Leiserson, R. Rivest and C. Stein, Introduction to Algorithms, 2nd Edition, PrenticeHall,2002.
2.Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag, New York, May2001.

Reference Books :

1. OdedGoldrich, Foundations of Cryptography-Basics, vol-1, Cambridge Univ. Press,2005.
2. OdedGoldrich, Foundations of Cryptography-Applications, vol-2, Cambridge Univ. Press,2005.
3. R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge University Press,1995.
4. William Stallings, Cryptography and Network security: Principles and Practice, 3rd Ed, Prentice Hall,2003.

Quantum Computing

Module1:

Introduction to Quantum Computation: Quantum bits, Bloch sphere representation of a qubit, multiple qubits. **Background Mathematics and Physics:** Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

Module2:

Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits. **Quantum Information and Cryptography:** Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.

Module3:

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search. **Noise and error correction:** Graph states and codes, Quantum error correction, fault-tolerant computation.

Text Books:

1. Nielsen M. A., **Quantum Computation and Quantum Information**, Cambridge University Press.
2. Benenti G., Casati G. and Strini G., **Principles of Quantum Computation and Information**, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, WorldScientific.
3. Pittenger A. O., **An Introduction to Quantum ComputingAlgorithms**

COMPUTER GRAPHICS

Module – I (08 hours)

Overview of Graphics System: Video Display Units, Raster-Scan and Random Scan Systems, Graphics Input and Output Devices. Output Primitives: Line drawing Algorithms: DDA and Bresenham's Line Algorithm, Circle drawing Algorithms: Midpoint Circle Algorithm and Bresenham's Circle drawing Algorithm. Two Dimensional Geometric Transformation: Basic Transformation (Translation, Rotation, Scaling) Matrix Representation, Composite Transformations, Reflection, Shear, Transformation between coordinate systems.

Module – II (07 hours)

Two Dimensional Viewing: Window-to- View Port Coordinate Transformation. Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm) Aliasing and Antialiasing, Half Toning, Thresholding, Dithering. Polygon Filling: Seed Fill Algorithm, Scan line Algorithm. Two Dimensional Object Representations: Spline Representation, Bezier Curves, B-Spline Curves. Fractal Geometry: Fractal Classification and FractalDimension.

Module – III (08 hours)

Three Dimensional Geometric and Modeling Transformations: Translation, Rotation, Scaling, Reflections, shear, Composite Transformation. Projections: Parallel Projection, Perspective Projection. Visible Surface Detection Methods: Back-Face Detection, Depth Buffer, A- Buffer,

Scan- Line Algorithm, Painters Algorithm.

Module – IV (07 hours)
Illumination Models: Basic Models, Displaying Light Intensities. Surface Rendering Methods: Polygon Rendering Methods: Gouraud Shading, Phong Shading. Computer Animation: Types of Animation, Key frame Vs. Procedural Animation, Methods of Controlling Animation, Morphing.

Textbook:
1. Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education.

Reference Books:
1. Computer Graphics Principle and Practice, J.D. Foley, A. Dam, S.K. Feiner, AddisonWesley.
2. Procedural Elements of Computer Graphics, David Rogers,TMH.
3. Computer Graphics: Algorithms and Implementations, D.P Mukherjee, D. Jana,PHI.
4. Computer Graphics, Z. Xiang, R. A. Plastock, Schaum's Outlines, McGrowHill.
5. Computer Graphics, S. Bhattacharya, Oxford UniversityPress.

Ad-hoc & Sensor Networks

Module-1:
Introduction to Ad Hoc Wireless Networks: Characteristics of MANETs, Applications of MANETs, Challenges. **Routing in MANETs:**Topology-based versus Position-based approaches, Topology based routing protocols, Position based routing, Other Routing Protocols. **Data Transmission In MANETs:** The Broadcast Storm, Multicasting, Geocasting**TCP over Ad Hoc Networks:** TCP Protocol overview, TOP and MANETs, Solutions for TOP over Ad Hoc

Module-2:
Basics of Wireless Sensors and Applications: The Mica Mote, Sensing and Communication Range, Design issues, Energy consumption, Clustering of Sensors, Applications **Data Retrieval In Sensor Networks:** Classification of WSNs, MAC layer, Routing layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

Module-3:
Security: Security in Ad hoc Wireless Networks, Key Management, Secure Routing, Cooperation in MANETs, Intrusion Detection Systems. Sensor Network Platforms and Tools: Sensor Network Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms **Operating System — TinyOS Imperative Language**: nesC, Dataflow style language: T1nyGALS, Node- Level Simulators, ns-2 and its sensor network extension,TOSSIM

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TEXT BOOKS

1. Ad Hoc and Sensor Networks — Theory and Applications, Car/osCorderlo Dharma R Aggarwal, World Scientific Publications /Cambridge University Press, March2006

2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009.

REFERENCE BOOKS

1. Adhoc Wireless Networks — Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education,2004

2. Wireless Sensor Networks — Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group,2010

3. Wireless Ad hoc Mobile Wireless Networks — Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group,2008.

4. Ad hoc Networking, Charles E.Perkins, Pearson Education,2001.

5. Wireless Ad hoc Networking, Shih-Liri Wu, Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group,2007

6. Wireless Ad hoc and Sensor Networks — Protocols, Performance and Control, JagannathanSarangapani, CRC Press, Taylor & Francis Group, 2007, rp2010.

7. Security in Ad hoc and Sensor Networks, Raheem Beyah, et al., World Scientific Publications / Cambridge University Press,2010

8. Ad hoc Wireless Networks — A communication-theoretic perspective, OzanK.Tonguz, Giatuigi Ferrari, Wiley India, 2006,rp2009.

Cryptography & Network Security

Module-I: (10 Hours)

Principles of Security Goals, Basic Cryptographic techniques, Classification of attacks, Virus, Worm, Trojan Horse, Spam etc. Cryptography: Concepts and Techniques: Introduction, plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption. Symmetric Key Cryptography: Algorithm types(DES, IDEA, RC4, RC5, Blowfish and AES) and modes, Cryptographic Algorithms Asymmetric Key Cryptographic Algorithms, Digital Signature Digital Envelope.

Module II: (10 Hours)

Number Theory – Divisibility, Congruences, Quadratic residues and residuacity, Abstract Algebra – Groups, rings, fields, construction of finite fields, cryptography, Stream Ciphers –

One-time Pad (OTP), Perfect secrecy, Pesudo-random generators (PRG), Attacks on stream ciphers and OTP, Real world stream ciphers, Semantic security, Block ciphers- DES, attacks, AES, Block ciphers from PRG, Modes of operation – one-time key and many-time keys, CBC, CTR modes, Message Authentication Code, Message Digest, Message Integrity – MAC, MAC based on PRF, NMAC, PMAC, Collision resistance – Birthday attack, Merkele-Damgard construction, HMC, Case study:SHA-256..Public-Key Infrastructure (PKI) Authentication: Classifications, Mutual authentication Algorithms, Kerberos .Security in layers and domains: IPsec, Secure Socket Layer (SSL), E-mail Security Electronic transactions.

Module III: (10 Hours)

Authenticated encryption, Key CO1 Understand Number Theory and Algebra for design of cryptographic algorithms CO2 Construct finite fields CO3 Analyse and compare symmetric-key encryption public-key encryption schemes based on different security models CO4 Apply Interactive proofs, Commitment protocols, Zero-knowledge proofs, Non-interactive proofs, CO5 Design and analyze digital cash system and electronic voting system exchange algorithms, Public key cryptosystems – RSA, ElGamal, Rabin, Elliptic curve cryptosystems – PKC, key exchange, IBE, Lattice based cryptosystem.

Text Books:

1. Cryptography and Network Security :AtulKahate ,TMH
2. Cryptography and Network Security : Principles & Practices : William Stallings, 4thEdition Pearson &PrinticeHall
3. Network Security : Kaufman , Perlman, Speciner, PearsonEducation

Reference Books:

1. N. Koblitz, Number Theory and Cryptography, Springer,2001
2. J. Katz and Y. Lindell, Introduction to Modern Cryptography, CRC press,2008.
3. Menezes, et.al, Handbook of Applied Cryptography, CRC Press,2004.
4. Golreich O, Foundations of Cryptography, Vol.1.2, Cambridge University Press,2004

COMPUTATIONAL GEOMETRY

Module-1:

Algorithmic design paradigms (divide and conquer, incremental, sweep line, and prune and search) and basic data structures (segment and interval trees).

Module-2:

Geometric searching: point locations (slab and chain methods) and range searching (kD and range trees); Convex hull: Graham's scan, gift wrapping, quick hull, divide-and-conquer; Voronoi diagram and Delaunay triangulation: properties and construction algorithms (sweep line and divide-and-conqueralgorithms).

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Module-3:

Visibility and Art gallery problems, motion planning and shortest paths. Arrangements and duality; Line segments intersection problem; closest pair computation.

Text Books :

1. F. P. Preparata and M. I. Shamos, Computational Geometry: An Introduction, Springer-Verlag, 1985.

Reference Books :

1. J. O'Rourke, Computational Geometry in C, 2nd Ed, Cambridge University Press,1998.
2. M. Laszlo, Computational Geometry and Computer Graphics in C++, Prentice-Hall,1996.
3. M. De Berg, M. van Kreveld, M. Overmars, O. Schwarzkopf, ComputationalGeometry: Algorithms and Applications, Springer -Verlag,1997.

Object Oriented Analysis & Design

Module1:

Overview of Object Oriented Systems Development: Two Orthogonal Views of the Software, Concept of Object Oriented Software, Importance of Object Oriented Software, Object Oriented Future, Object Oriented Systems Development Methodology, Overview of Unified Approach.

Object Basics: An Object Oriented Philosophy, Objects, Object Behavior, Object Oriented Properties, Association and Aggregation.Object Oriented Systems Development Life Cycle: The Process of Software Development, Developing Good Quality Software, Use Case Driven Approach for Object Oriented Systems Development, Reusability.Object Oriented Methodologies: Introduction, Types of Object Oriented, Methodologies, Patterns, Unified Approach.

Module-2:

Unified Modeling Languages (UML): Overview of Unified Modeling Language (UML), Static and Dynamic Models, UML Diagrams, UML Class Diagrams, Use-Case Diagrams, UML Dynamic Modeling, Implementation diagrams, Model Management: Package and Model Organization, UML Extensibility, UML Meta-Model. Object Oriented Analysis – Identifying Use-Cases: Complexity in Object Oriented Analysis, Business Process Modeling and Business Object Analysis, Use-Case Driven Object Oriented Analysis, Use-Case Model, Developing Efficient Documentation. Object Analysis: Classification: Object Analysis, Classification Theory, Approaches for Identifying Classes, Class Responsibility Collaboration. Object Oriented Analysis – Identifying Relationships, Attributes, and Methods: Introduction, Associations, Inheritance Relationships, A Part of Relationship-Aggregation, Class Responsibility: Identifying Attributes and Methods, Class Responsibility: Defining Attributes, Object Responsibility: Methods andMessages.

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Module-3:

Object Oriented Design Process and Design Axioms: Design Process, Design Axioms, Corollaries, Design Patterns. Designing Classes: The Object Oriented Design Principles, UML Object Constraint Language (OCL), Strategies for Designing Classes, Class Visibility: Designing Public Private and Protected Protocols, Designing Classes: Refining Attributes, Designing Methods and Protocols, Packages and Managing Classes. Access Layer: Object Store and Persistence, Database Management Systems, Logical and Physical Database Organization and Access Control, Object Oriented Database Management Systems (OODBMS), Object Relational Systems, Designing Access Layer Classes.

View Layer: User Interface Design as a Creative Process, Designing View Layer Classes, Purpose of a View Layer Interface, Prototyping the User Interface. Software Quality Assurance: Quality Assurance Tests, Software Testing Techniques, Testing Strategies, Impact of Object Orientation on Testing, Test Cases, Test Plan, Myer's Debugging Principles. System Usability and Measuring User Satisfaction: Usability Testing, User Satisfaction Test, Analyzing User Satisfaction by Satisfaction Test Template, Developing Usability Test Plans and Test Cases.

Text Book:

1. Ali Bahrami, "Object Oriented System Development", McGraw Hill,1999.

2. Grady Booch. "Object-oriented Analysis and Design with Applications, 3rd edition, Addison-Wesley2007.

Entrepreneurship Development (3-0-0)

Prerequisites:

1. Organizational Behaviour.
2. English.

Module 1: (06 Hours)

Entrepreneurship: Concept of Entrepreneurship and Intrapreneurship, Types of Entrepreneur, Nature and Importance, Entrepreneurial Motivation and Achievement, Entrepreneurial Personality & Traits and Entrepreneurial Skills.

Module 2: (08 Hours)

Entrepreneurial Environment, Identification of Opportunities, Converting Business, Opportunities into reality. Start-ups and business incubation, Skill Development. Setting up a Small Enterprise. Issues relating to location, Environmental Problems and Industrial Policies andRegulations.

Module 3: (08 Hours)

Basics of Accounting, Terms: Assets, Liabilities, Equity, Revenue, Expense, Working capital, Marketing Mix and STP.

HRM: Concepts and Function, Labour Laws- Factories Act, Organizational sup- port services - Central and State Government, Incentives and Subsidies.

Module 4: (08 Hours)

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Sickness of Small-Scale Industries, Causes and symptoms of sickness, cures of sickness, Role of Banks and Government in reviving sick industries.

Text Books:

1. Entrepreneurship Development and Management, Vasant Desai, HPH.
2. Entrepreneurship Management, Bholanath Dutta, ExcelBooks.
3. Entrepreneurial Development, Sangeeta Sharma, PHI.
4. Entrepreneurship, Rajeev Roy, Oxford UniversityPress.

Optimization Techniques

Course Objectives:

1. To understand the theory of optimization methods and algorithms developed for solving various types of optimizationproblems.
2. To introduce the students about optimization concepts, formulation of engineering problems amenable tooptimization.
3. To provide students with the modeling skills necessary to describe, formulate, solve and interpret optimization problems inengineering.
4. To find the solution of optimal decision making and engineering design problems in which the objective and constraints are linear or nonlinearfunctions.

Syllabus

Module-I:

Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling. Linear Programming: Formulation of LPP, Graphical solution, Simplex method, Big M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming.

Module-II:

Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method. Assignment problems: Hungarian method for solution of Assignment problems. Integer Programming: Branch and Bound algorithm for solution of Integer Programming problems. Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, .

Module-III:

Introduction to non-linear programming, Unconstrained optimization: Fibonacci and Golden Section Search method, Steepest Descent Method, Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method, Constrained optimization with inequality constraint: Kuhn-Tucker condition, Primal-Dual Method, Quadratic programming.

Text Book :

1. Ravindran, D. T. Philips, J. Solberg, " Operations Research- Principle and Practice", Second edition, Wiley India PvtLtd
2. Kalyanmoy Deb, " Optimization for Engineering Design", PHI Learning PvtLtd

Reference Books :

1. An introduction to Linear Algebra by V. Krishnamurthy, V. P. Mainra and J. L. Arora, East WestPublication
2. M.Artin, Algebra, Prentice-Hall of India.
3. Hoffman and Kunze, Linear Algebra, 2nd ed.,PHI.
4. H.A.Taha,A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, "Operations Research", Eighth Edition, Pearson Education
5. F.S.Hiller, G.J.Lieberman, " Operations Research", Eighth Edition, Tata McDrawHill
6. P.K.Gupta, D.S.Hira, "Operations Research", S.Chand and CompanyLtd.
7. KantiSwarup, P. K. Gupta, Man Mohan, "Operations Research", Sultan Chand andSons

Course Outcomes: On successful completion of this course, the students will be able to

1. understand and use methods for constrained and unconstrainedOptimization,
2. understand the mathematical background to solve optimizationproblems,
3. formulate and solve nonlinear programming problems from real fielddata,
4. demonstrate the ability to choose and justify optimization techniques that are appropriate for solving realistic engineeringproblems.

Cloud Computing

Module1:
Business and IT perspective, Cloud and virtualization, Cloud services requirements, cloud and dynamic infrastructure, cloud computing characteristics, cloud adoption. Cloud characteristics, MeasuredService,

Module2:
Cloud models, security in a public cloud, public verses private clouds, cloud infrastructure self service. Gamut of cloud solutions, principal technologies, cloud strategy, cloud design and implementation using SOA, Conceptual cloud model, cloud service demand. Cloud ecosystem, cloud business process management, cloud service management, cloud stack, computing on demand, cloudsourcing.

Module3:
Cloud analytics, Testing under cloud, information security, virtual desktop infrastructure, Storage cloud. Resiliency, Provisioning, Asset management, cloud governance, high availability and disaster recovery, charging models, usage reporting, billing and metering. Virtualization defined, virtualization benefits, server virtualization, virtualizationfor

x86 architecture, Hypervisor management software, Logical partitioning, VIO server, Virtual infrastructure requirements**.** Storage virtualization, storage area networks, network attached storage, cloud server virtualization, virtualized data center. SOA journey to infrastructure, SOA and cloud, SOA defined, SOA defined, SOA and IAAS, SOA based cloud infrastructure steps, SOA business and IT services.

TEXTS

1. Cloud Computing by Dr. Kumar Saurabh, Wiley India, 2011.

Reference

1. Michael Miller, Cloud Computing: Web based applications that change the way you work and collaborate online, Que publishing , August2009
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On Demand computing applications and data Centers in the Cloud with SLAs, EmereoPty Limited, July2008.

VLSI System Design

Module-1:

Introduction :IntroductiontoICtechnology–TheICera–MOSandrelatedVLSItechnology – Basic MOS transistors – Enhancement and depletion modes of transistor action – IC production process – MOS and CMOS fabrication process – BiCMOS technology – Comparison b/w CMOS and bipolar technologies. **Basic electrical properties of MOS and BiCMOScircuits** : Ids–Vds relationships – Aspects of MOS transistor threshold voltage – MO Trans– conductance and output conductance – MOS Transistor – Figure of merit – The pMOStransistor – The nMOS inverter – Determination of pull– up to pull–down ratio for nMOS inverter driven by another nMOS inverter for an nMOS inverter driven through one or more pass Transistors – Alternative forms of pull up – The CMOS Inverter MOS transistor Circuit model – Bi–CMOS Inverters.

Module-2:

MOS and BiCOMS circuit design processes :MOS layers – Stick diagrams – Design rules and layout – General observation on the design rules, 2µm double metal, double poly – CMOS/BiCMOS rules, 1.2µm Double metal, Double poly CMOS rules – Layout diagrams of NAND and NOR gates and CMOS inverter – Symbolic Diagrams – Translation to Mask Form.

Basic circuit concepts : Sheet resistance – Sheet resistance concept applied to MOS transistor and inverters – Area capacitance of layers – Standard unit of capacitance – Some area capacitance calculations – The delay unit – Inverter delays – Driving large capacitive loads – Propagations Delays – Wiring Capacitance – Fan–in and Fan–out characteristics – Choice of layers – Transistor switches – Realization of gates using nMOS, pMOS and CMOStechnologies.

Module-3:

Scaling of MOS circuit : Scaling models and scaling factors – Scaling factors for device parameters – Limitations of scaling – Limits due to sub threshold currents – Limits on logic level

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and supply voltage due to noise – Limits due to current density – Some architectural Issues – Introduction to switch logic and gate logic. **Digital design using HDL** : Digital system design process – VLSI Circuit Design Process – Hardware simulation – Hardware Synthesis – History of VHDL – VHDL requirements – Levels of abstraction – Elements of VHDL – Packages – Libraries and bindings – Objects and classes – Variable assignments – Sequential statements – Usage of subprograms – Comparison of VHDL and verilog HDL. **VHDL MODELLING** : Simulation – Logic Synthesis – Inside a logic synthesizer –Constraints – Technology libraries – VHDL and logic synthesis – Functional gate – Level verification – Place and route – Post layout timing simulation – Static timing – Major net list formats for design representation – VHDL synthesis – Programmingapproach.

Text Books

1. Essentials of VLSI Circuits and Systems–Kamran Eshraghian, Douglas andA.Pucknell and SholehEshraghian, Prentice–Hall of India Private Limited, 2005Edition.
2. VLSI Design–K. Lal Kishor and V.S.V.Prabhakar, I.K. International PublishingHouse Private Limited, 2009 FirstEdition.
3. VLSI Design–A.Shanthi and A.Kavitha, New Age International Private Limited,2006 FirstEdition.

References Books

1. VLSI Design ByDebaprasad Das, Oxford UniversityPress,2010.
2. VLSI Design By A.Albert Raj & T. Latha, PHI Learning Private Limited,2010.

ADAVANCED ALGORITHMS

MODULE-I: [10 Hours]
Algorithm paradigms, Asymptotic notations, Recurrences, Divide and conquer(Merge sort, Heap sort, Quick sort and its correctness proofs), Priority Queue, Lower bounds for sorting, Leftist heaps, Binomial heaps, Fibonacci heaps, Skew heaps.

MODULE-II: [10 hours]
Search and Multimedia Structure: Binary Search Tree, AVL Tree, 2-3 Tree, B-Tree, B+ Tree, Red-Black Tree, Segment Tree, k-d Tree, Point Quad Trees, R-Tree, Data structure for disjoint sets: Disjoint set operations, Linked list representation, path compression, Disjoint set forests. Hashing: Hash Function, Collision Resolution Techniques

MODULE-III: [10 hours]
Dynamic Programming (LCS, Floyd-Warshall Algorithm, Matrix Chain Multiplication), Greedy Algorithm (Single Source Shortest Path, Knapsack problem, Huffman codes, Minimum Cost Spanning Trees), Geometric Algorithm (Convex hulls, Segment Intersections, Closest Pair), Internet Algorithm (Tries, Ukonnen's Algorithm, Text pattern matching), Numerical Algorithm (Integer, Matrix and Polynomial multiplication, Extended Euclid's algorithm) Polynomial Time, Polynomial-Time Verification, NP Completeness & reducibility, NP Completeness proofs, Cook's theorem

Reference Books:
1. T. H. Cormen, C. E. Leiserson, and R. L. Rivest, "Introduction to Algorithms",PHI.
2. E. Horowitz, S. Sahani and Dinesh Mehta, Fundamentals of Data Structures in C++,Galgotia.
3. Mark Allen Weiss, "Data Structures & Algorithm Analysis in C/C++", Pearson Edu.India.
4. Adam Drozdex, Data Structures and algorithms in C++, Thomasonlearning.

PARALLEL AND DISTRIBUTED SYSTEM

Module – I (10Hrs.)
Introduction to parallel computing.
Parallel programming platforms: Trends in microprocessor Architectures, Limitations of memory system performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, communication costs in parallel machines, Routing mechanisms for interconnection network, Impact of process processors mapping and mapping techniques.

Module – II (10Hrs.)
Principles of parallel algorithm design: Preliminaries, Decomposition techniques, Characteristics of tasks and interactions, Mapping techniques for load balancing, Methods for containing.

Interactions overheads, Parallel algorithm models. Basic communication operations: One-to-All

Broadcast and All-to-One Reduction, All-to-All broadcast and reduction All-Reduce and prefix sum operations, scatter and gather, All-to-All personalized communication, circular shift, Improving the speed of some communication operation.

Module – III (10Hrs.)

Analytical modeling of parallel programs: Performance metrics for parallel systems, Effect of granularity of performance, scalability of parallel system, Minimum execution time and minimum cost-optimal execution time, Asymptotic analysis of parallel programs, other scalability metrics. Programming using the message passingparadigm:

Principle of message – Passing programming, Send and receive operations, The message passing interface, Topologies and embedding, Overlapping communication with computation, collective communication and computation operations, Groups and communicators.

Dense matrix algorithm: Matrix-vector multiplication, Matrix-matrix algorithm, Solving a system of linearequations.

Text Book:

1. Introduction to Parallel Computing, Second Edition, Ananth Gram, Anshul Gupta, George Karypis, Vipin Kumar PersonEducation.
2. Parallel computing Theory and Practice, Second Edition, Michael J. Quinn,TMH.

Real Time Systems

Module-1 [10Hrs]

Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteistics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints , Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations.

Module-2 [10Hrs]

Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP. Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies. Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization

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Module-3 [10Hrs]

Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system, POSIX, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.

Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Real-time Communication: Examples of applications requiring real-time communication, Basic concepts, Real-time communication in a LAN. Soft Real-time communication in a LAN. Hard real-time communication in a LAN. Bounded access protocols for LANs. Performance comparison, Real-time communication over packet switched networks. QoS framework, Routing, Resource reservation, Rate control.

Text Books:

1. Real-time Systems Theory and Practice by Rajib Mall, PearsonsPublication
2. C.M.Krishna and Kang G.Shin, "Real Time Systems", McGraw Hill InternationalEdition.

Reference Books:

1. Stuart Bennett, " Real Time Computer Control, An Introduction", Prentice Hall Internation Edition, 1988.
2. Peter D.Lawrence, "Real Time Micro-Computer System Design, An Introduction", Konrad Manch, McGraw Hill,1988.
3. S.T.Allworth and R.N.Zobel, "Introduction to Real Time Software Design", Macmillan Education, Second edition,1987.

COMBINATORICS & GRAPH THEORY

Module-1:

Fundamental concepts (basic definitions, operations, properties, proof styles); Trees (properties, distances and centroids, spanning trees, enumeration); Matchings (bipartite graphs, general graphs, weighted matching)

Module-2:

Connectivity (vertex and edge connectivity, cuts, blocks, k-connected graphs, network flows); Traversibility (Eulerian tours, Hamiltonian cycles); Coloring (vertex and edge coloring, chromatic number, chordal graphs);

Module-3:

Planarity (duality, Euler's formula, characterization, 4-color theorem); Advanced topics (perfect

graphs, matroids, Ramsay theory, extremal graphs, random graphs); Applications.

Text Book:

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall ofIndia.
2. NarsinghDeo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall.
3. Frank Harary, Graph Theory,Narosa.
4. R. Ahuja, T. Magnanti, and J. Orlin, Network Flows: Theory, Algorithms, and Applications,Prentice-Hall.

Human Computer Interaction

Module-1

TheHuman:I/Ochannels–Memory–Reasoningandproblemsolving;Thecomputer:Devices –Memory–processingandnetworks;Interaction:Models–frameworks–Ergonomics–styles – elements – interactivity- Paradigms. Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

Module-2

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW. Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

Module-3

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education,2004
2. Brian Fling, “Mobile Design and Development”, First Edition ,O‟Reilly Media Inc., 2009
3. Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O‟Reilly,2009

Big Data Analytics

Module1:

Introduction: Big Data Overview, The rising and importance of data sciences, Big data analytics

in industry verticals Hadoop Architecture: Hadoop Architecture, Hadoop ecosystem components, Hadoop Storage: HDFS, Hadoop Processing: MapReduce Framework, Hadoop ServerRoles

Module2:
Data Analytics Lifecycle and methodology: Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, Communicating results, Deployment, Data exploration & preprocessing Data Analytics - Theory & Methods: Measures and evaluation, Supervised learning, Linear/Logistic regression, o Decision trees, Naïve Bayes, Unsupervised learning, K-means clustering, Association rules, Unstructured Data Analytics, Technologies & tools, Text mining, Web mining

Module3:
The Endgame: Opertionalizing an Analytics project, Data Visualization Techniques, Creating final deliverables

Text Books:

1. Hadoop: The Definitive Guide by TomWhite
2. Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL,and Graph by DavidLoshin
3. Machine Learning by Tom M.Mitchell

INFORMATION RETRIEVAL

Module1:

Introduction: concepts and terminology of information retrieval systems, Information Retrieval Vs Information Extraction; Indexing: inverted files, encoding, Zipf's Law, compression, booleanqueries;

Module2:

Fundamental IR models: Boolean, Vector Space, probabilistic, TFIDF, Okapi, language modeling, latent semantic indexing, query processing and refinement techniques; Performance Evaluation: precision, recall,

Module3:

F-measure; Classification: Rocchio, Naive Bayes, k-nearest neighbors, support vector machine; Clustering: partitioning methods, k-means clustering, hierarchical; Introduction to advanced topics: search, relevance feedback, ranking, queryexpansion.

Text Books :

1. Christopher D. Manning, PrabhakarRaghavan and HinrichSchtze, Introduction to Information Retrieval, Cambridge University Press.2008

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2. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, Modern Information Retrieval, Addison Wesley, 1stedition,1999.

Reference Books :

1. SoumenChakrabarti,MiningtheWeb,Morgan-KaufmannPublishers,2002.
2. Bing Liu, Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Springer, Corr. 2nd printing edition,2009.
3. David A. Grossman, Ophir Frieder, Information Retrieval: Algorithms and Heuristics, Springer, 2ndedition,2004.
4. William B. Frakes, Ricardo Baeza-Yates, Information Retrieval Data Structures and Algorithms, Prentice Hall,1992.
5. G. Salton, M. J. McGill, Introduction to Modern Information Retrieval, McGraw-Hill,1986.
6. C. J. Van Rijsbergen, Information Retrieval, Butterworth-Heinemann;2nd edition,1979.

Machine Learning

Module 1:
Algorithmic models of learning. Learning classifiers, functions, relations, grammars, probabilistic models, value functions, behaviors and programs from experience. Bayesian, maximum a posteriori, and minimum description lengthframeworks.

Module 2:
Parameter estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers.

Module 3:
Computational learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting. Dimensionality reduction, feature selection and visualization. Clustering, mixture models, k-means clustering, hierarchical clustering, distributionalclustering.

Module 4:
Reinforcement learning; Learning from heterogeneous, distributed, data and knowledge. Selected applications in data mining, automated knowledge acquisition, pattern recognition, program synthesis, text and language processing, internet-based information systems, human-computer interaction, semantic web, and bioinformatics and computational biology.

Text Book:

1. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin:Springer-Verlag

Reference Books:

Abbreviations Used: L = Lectures, P = Practical or Laboratory, T = Tutorial

IA = Internal Assessment , PA = Practical Assessment, EA = End-Semester Assessment

1. Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine LearningApproach. Cambridge, MA: MITPress.
2. Bishop, C. M. Neural Networks for Pattern Recognition. New York: Oxford University Press(1995).
   Chakrabarti, S. (2003). Mining the Web, Morgan Kaufmann.
3. Cohen, P.R. (1995)Empirical Methods in Artificial Intelligence. Cambridge, MA:MIT Press.
4. Cowell, R.G., Dawid, A.P., Lauritzen, S.L., and Spiegelhalter,D.J. (1999).Graphical Models and Expert Systems.Berlin:Springer.
5. Cristianini, N. and Shawe-Taylor, J. (2000). An Introduction to SupportVector Machines. London: Cambridge UniversityPress.

Neural Networks & Deep Learning

Module-1:

Introduction to deep learning, History and cognitive basis of neural computation., The perceptron / multi-layer perceptron, The neural net as a universal approximator, Training a neural network, Perceptron learning rule, Empirical Risk Minimization, Optimization by gradient descent, Back propagation, Calculus of back propogation, Stochastic gradient descent, Acceleration, Overfitting andregularization

Module-2:

Convolutional Neural Networks (CNNs), Weights as templates, Translation invariance, Training with shared parameters, Arriving at the convlutional model, Models of vision, Neocognitron, Mathematical details of CNNs, Alexnet, Inception, VGG, Recurrent Neural Networks (RNNs), Modeling series, Back propogation through time, Bidirectional RNNs, Stability, Exploding/vanishing gradients, Long Short-Term Memory Units (LSTMs) and variants, Resnets, Loss functions for recurrent networks, Sequence prediction, Sequence To Sequence Methods

Module-3:

Connectionist Temporal Classification (CTC), What to networks represent, Autoencoders and dimensionality reduction, Learning representations, Sequence-to-sequence models, Attention models, examples from speech and language, VariationalAutoencoders (VAEs), Generative Adversarial Networks (GANs), Hopfield Networks, Energy functions, Training Hopfield Networks, Stochastic Hopfield Networks, Restricted Boltzman Machines, Deep Boltzman Machines, Reinforcement Learning, Q Learning, Deep Q Learning

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IA = Internal Assessment , PA = Practical Assessment, EA = End-Semester Assessment

Text Books:

1. Deep Learning By Ian Goodfellow, YoshuaBengio, Aaron Courville*Online book,2017*
2. Neural Networks and Deep Learning By Michael Nielsen *Online book, 2016*
3. Deep Learning with Python By J.Brownlee
4. Deep Learning Step by Step with Python: A Very Gentle Introduction to Deep Neural Networks for Practical Data Science By N. D.Lewis

Internet Of Things (IOT)

MODULE I(07hrs)

Introduction to Internet of Things: Introduction-Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT , Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , **IoT Architectures:** Architectures for IoT, Elements of an IoT Architecture, Architectural design considerations IoT Enabling Technologies- Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, IoT Levels &Deployment.

MODULE II (08hrs)

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities-Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, Environment-Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection ,River Floods Detection , Energy-Smart Grids , Renewable Energy Systems , Prognostics , Retail-Inventory Management , Smart Payments , Smart Vending Machines , Logistics-Route Generation & Scheduling , Fleet Tracking,ShipmentMonitoring,RemoteVehicleDiagnostics,Agriculture-SmartIrrigation ,Green House Control ,Industry -Machine Diagnosis & Prognosis Indoor Air QualityMonitoring ,Health& Lifestyle -Health &Fitness Monitoring, Wearable Electronics **IoT and M2M** M2M-Difference between IoT and M2M, SDN and NFV for IoT-Software Defined Networking, Network Function Virtualization.

MODULE III(07hrs)

Case Study on IoT System for Weather Monitoring, What is an IoT Device-Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces – Serial, SPI , I2C , Programming with Python, Other IoT Devices- pcDuino, Beagle Bone Black , Cubieboard. IoT application programming: Introduction to IoT device programming, IoT applicationdevelopment

MODULE IV(08hrs)

IoT&Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of

RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data intensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools &Internet Of Everything. **Data analytics for IoT:** A framework for data-driven decision making, Descriptive, Predictive and Prescriptive Analytics, Business Intelligence and Artificial Intelligence, Importance of impact and open innovation in data-driven decision making.

Text Books:

1. Internet of Things, A Hands on Approach, by ArshdeepBahga& Vijay audisetti, University Press.

Reference Books:

1. The Internet of Things, by Michael Millen, Pearson

FOG COMPUTING

Module-1:

Fog Computing: Concepts, Principles and Related paradigms. Fog Computing in the IoT Environment: Principles, Features and models. Dichotomy of Fog Computing in the Realm of Cloud Computing: Exploring the Emerging Dimensions.

Module-2:

Fog Computing in a Developing world context: Jumping on the Bandwagon. Analyzing IoT, Fog and Cloud Environments using Real Sensor Data. Performance Enhancement of Fog Computing using SDN and NFV Technologies.

Module-3:

Mechanisms towards enhanced Quality of Experience(QoE) in Fog computing environments. Specifying Software Services for Fog Computing Architectures using Recursive Model Transformations. A Data Utility model for Data-Intensive Applications in Fog Computing Environments.

Text Books:

1. ”Fog Computing-Concepts, Frameworks and Technologies” by Zaigham Mahmood, Springer, 2018, ISBN 978-3-319-94889-8.

Reference Books:

1. “Fog and Edge Computing-Principles and Paradigms” by RajkumarBuyya, Satish Narayana Srirama, Wiley

Multi-Agent Intelligent Systems

Module-1:

Intelligent Agents : Intelligent Agents, Agents and Objects, Agents and Expert Systems, Agents as Intentional Systems, Abstract Architectures for Intelligent Agents **Deductive Reasoning Agents:** Agents as Theorem Provers , Agent-Oriented Programming , Concurrent MetateM

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Module-2:

Practical Reasoning Agents : Practical Reasoning = Deliberation + Means-Ends Reasoning , Means--Ends Reasoning , Implementing a Practical Reasoning Agent , The Procedural Reasoning System **Reactive and Hybrid Agents :** Reactive Agents , The Subsumption Architecture , PENGI, Situated automata , The Agent Network Architecture , The Limitations of Reactive Agents, Hybrid Agents , Touring Machines , InteRRaP, 3T ,Stanley

Module-3:

Understanding Each Other : Ontology Fundamentals , Ontology Building Blocks , An Ontology of Ontologies , Ontology Languages , XML -- Ad Hoc Ontologies , OWL -- The Web Ontology Language , KIF -- Ontologies in First-Order Logic , RDF, Constructing an Ontology , Software Tools for Ontologies **Multiagent Interactions :** Utilities and Preferences , Setting the Scene , Solution Concepts and Solution Properties , Dominant Strategies , Nash Equilibria , Pareto Efficiency , Maximising Social Welfare , Competitive and Zero-Sum Interactions , The Prisoner's Dilemma , The shadow of the future , Program Equilibria ,Other Symmetric 2 x2 Interactions , Representing Multiagent Scenarios ,Dependence Relations in Multiagent Systems

Text Book:

An Introduction to MultiAgent Systems - Second Edition, Michael Wooldridge, John Wiley & Sons 2009, ISBN-10: 0470519460, ISBN-13: 978-0470519462

VIRTUAL REALITY

Module-1:

Introduction : The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. (1.1, 1.3 and 1.5 of Text Book (1)). Input Devices : (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. (2.1, 2.2 and 2.3 of Text Book (1)). Output Devices: Graphics displays, sound displays & haptic feedback. (3.1,3.2 & 3.3 of Text Book (1))

Module-2:

Modeling : Geometric modeling, kinematics modeling, physical modeling, behaviour modeling, model management. (5.1, 5.2 and 5.3, 5.4 and 5.5 of Text Book (1)). Human Factors: Methodology and terminology, user performance studies, VR health and safety issues. (7.1, 7.2 and 7.3 of Text Book (1)). Applications: Medical applications, military applications, robotics applications. (8.1, 8.3 and 9.2 of Text Book (1)).

Module-3:

VR Programming-I : Introducing Java 3D, loading and manipulating external models, using a

lathe to make shapes. (Chapters 14, 16 and 17 of Text Book (2)). VR Programming-II : 3D Sprites, animated 3D sprites, particle systems. (Chapters 18, 19 and 21 of Text Book (2))

TEXT BOOKS:

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea& Philippe Coiffet, John Wiley & Sons,Inc.,
2. Killer Game Programming in Java, Andrew Davison, Oreilly-SPD,2005.

REFERENCE BOOKS:

1. Understanding Virtual Reality, interface, Application and Design, William R.Sherman,Alan Craig, Elsevier(MorganKaufmann).
2. 3D Modeling and surfacing, Bill Fleming, Elsevier(MorganKauffman).
3. 3D Game Engine Design, David H.Eberly, Elsevier.
4. Virtual Reality Systems, John Vince, PearsonEducation.